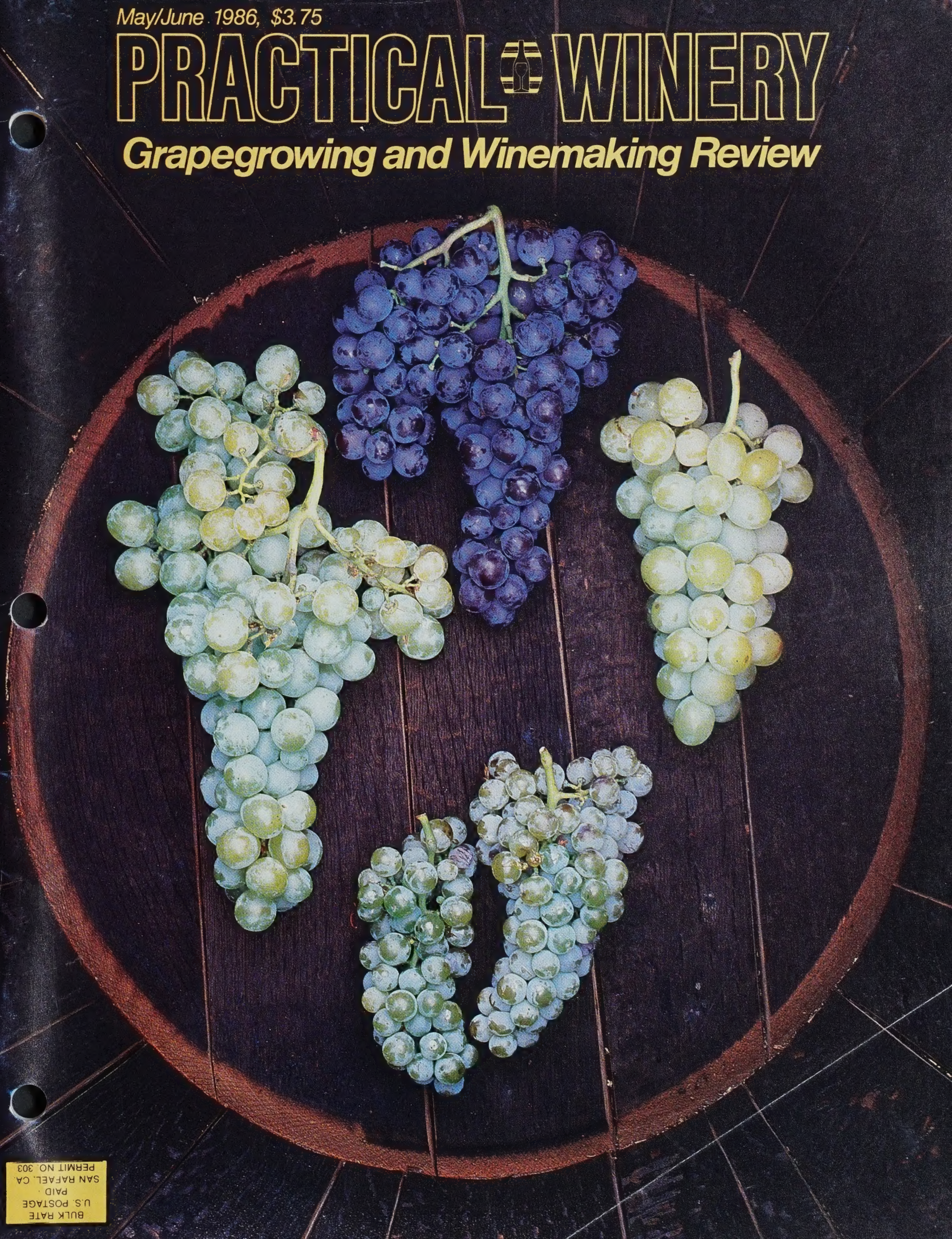
May/June 1986, $3.75

PRACTICAL WINERY

Grapegrowing and Winemaking Review



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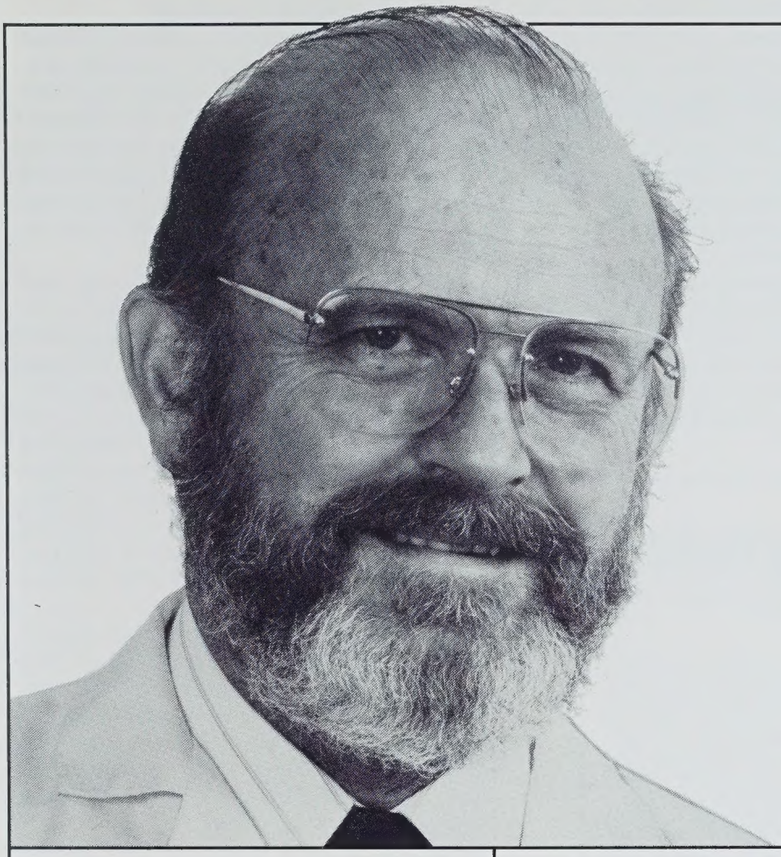

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Upcoming Events

June 19-20, 1986
Canadian Society of Oenologists

The 1986 Annual Meeting of the Canadian Society of Oenology and Viticulture will be held at Prudhommes Landing, Vineland, Ontario. Technical sessions on enology and viticulture are scheduled for the full-day meeting on Thursday and half-day meeting on Friday. Speakers will include prominent researchers and winemakers from Ontario and the U.S.

For information, contact Canadian Society of Oenologists, Hillebrand Estates Winery, R.R.2, Hwy.55, Niagara-on-the-Lake, Ontario, Canada L0S 1J0; phone: (416) 468-7205.

June 25-28, 1986
American Society for Enology and Viticulture

The 1986 ASEV conference will be held at the Marriot Hotel, Anaheim, CA. Lectures include the effect of must oxidation on quality of white wines, Charles W. Nagel; an evaluation of genetically improved wine yeast strains, Douglas Fong; effects and interactions of hedging, shoot positioning, trellising, and pruning level on fruit composition and crop yield, Mark Kliewer; and biotechnology for grape improvement, Carole P. Meredith.

Poster sessions include barrel preparation and treatment methods as a factor in maturation of wine, Robert Léauté; wine-food preference study, Louis P. Martini; and evaluation of retained crop as a measure of machine and hand harvesting efficiency, Anna Darden and Anthony J. Baldini.

July 14-17, 1986
Australia Wine Industry Technical Conference

The Sixth Australian Wine Industry Technical Conference will be held in Adelaide, Australia. The Conference is being organized jointly by the Australian Wine Research Institute and the Australian Society of Viticulture and Oenology. Overseas and Australian speakers will discuss key areas of viticulture and oenology that are of current interest and importance.

Topics will include 'Grapegrowing and Winemaking Objectives in Australia' by I.J. McKenzie and B.J. Croser; 'Grapevine Genetics' by Dr. C.P. Meredith of the USA and Professor M.G. Mullins; 'Yeast Biochemistry' by Dr. P.R. Monk, Professor P. Ribereau-Gayon of France, Dr. Y. Uzuka of Japan, and Dr. J.W. May; 'Canopy Management' by Dr. A. Carbonneau of France, Dr. R.E. Smart of New Zealand, C.H. Kidd, and R.M. Cirami; and 'Yeast Genetics' by Dr. R.S. Tubb of Finland, Dr. R.J. Thornton of New Zealand, H. Gockowiak, and Dr. P. Langridge.

The Conference has planned a poster session and six workshops on selected viticultural and oenological topics. Workshops will include Grape and Wine Analysis by UV-VIS Spectrophotometry, Grape and Wine Analysis by HPLC, Image Analysis and Immunofluorescence Techniques, Grapevine Canopies, Water Management, and Grafting.

There will be a comprehensive trade exhibition of winemaking and vineyard equipment and materials in conjunction with the Conference.

For more information, write Mrs. Wendy Spriggs, The Australian Wine Research Institute, Private Mail Bag, Glen Osmond, SA, 5064, Australia.

August 4-10, 1986
Society of Wine Educators
10th Annual National Conference

The Conference will be held at the University of California, Davis. Speakers in the fields of enology, viticulture, sensory perception, medicine, and wine appreciation will be featured.

Seminars will include discussions on charting a course to wine profits, with Ed Osterland; responsibilities, opportunities, and pitfalls for the wine educator, with Vernon Singleton; restaurant consulting and the wine educator, with Steve Fox; photomicroscopy and wine sensory qualities, with Sondra Barrett; wine education—the answer to decreasing consumption, with Terrence Clancy; trends in dessert wines, with Andrew Quady; Zinfandel styles, with Bob Kozlowski; wine yeasts of the future, with Ralph Kunkee; and wine flavonoid flavors, with Leo McCloskey.

The professional seminar will include 'The Flavor Wheel and Meaningful Language Describing Wine', by Kay Simon; 'The Taste/Texture Triangle: A Proposal', by Don Blackburn; 'Wine Defects and Their Origins', by Lisa Van de Water; 'Humans as Sensory Instruments', by Christi Heintz; and 'Alcohol, Tolerance, and the "Smart" Drinker', by Roger E. Vogler, Wayne R. Bartz, and Nancy Webber.

Information about registration or attendance for the conference may be obtained by writing the Society of Wine Educators, 132 Shaker Rd., Siute 14, East Longmeadow, MA 01028.

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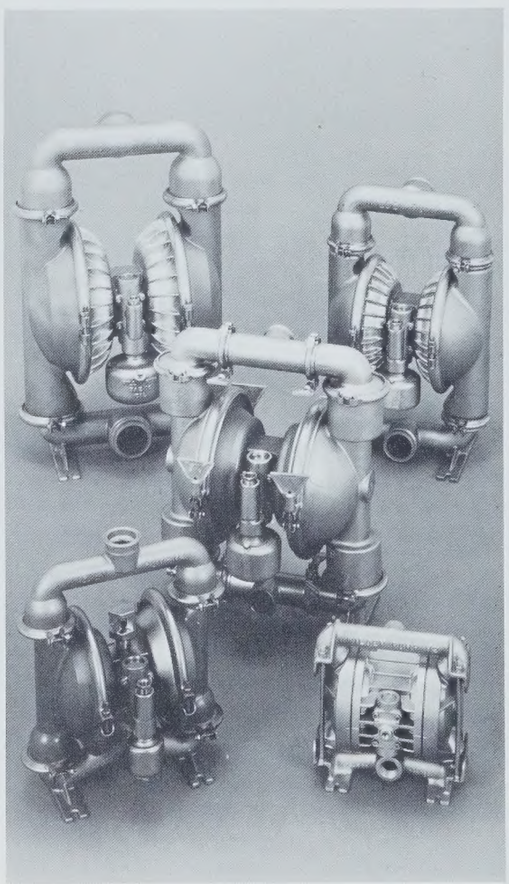

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PRACTICAL WINERY
Grapegrowing and Winemaking Review

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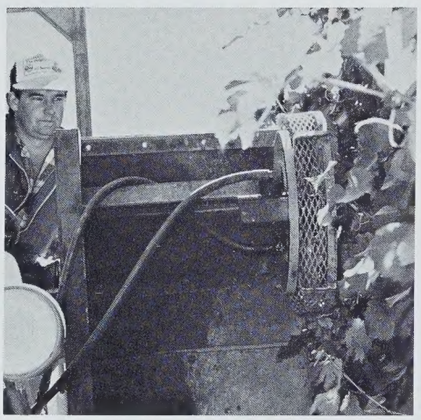

Leaf-pulling machine
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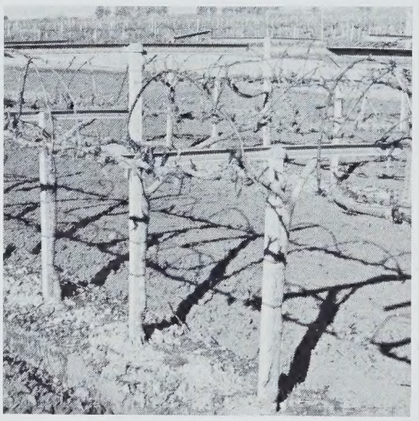


Close spacing at Ventana Vineyard
See page 68.

Cover

Four Muscat varieties (clockwise from top): Muscat Hamburg, Muscat of Alexandria, Orange Muscat, Muscat Canelli.

photo by Daniel D'Agostini

Letters to the Editor

Dear Editor:

The Wine Retailer 'Chardonnay: Boom or Bust' column (*PW*, March/April 1986) raised some questions we have seen before during each period of grape surplus. I was not comfortable with the answers offered, for I do not believe they represent either a sense of history or a participation in the collective groups which will determine our evolution.

What is the Chardonnay industry? Surprise—it is Sonoma County in the main and the Carneros region of Napa County. It is Chateau Montelena, Matanzas Creek, Grgich Hills, Bacigalupi, Chateau St. Jean, Merry Vintners/Merry Edwards, Simi, and several other trail blazers.

1. It is the champagne industry with pioneers Jamie and Jack Davies plus Hennessy (Domaine Chandon), Heidsieck (Piper Sonoma), Hanns Kornell, Korbel, et al. Their comments, sales and profits will tell the industry the state of the market and forecast the future. It is the geography, soils and wineries that created the Chardonnay business which we now all enjoy.

2. Behind it all are the cold- or controlled-fermentation systems developed by the University of California. Chardonnay and key small wineries are here to stay and show consistent growth of 20–35%/year when well-managed.

3. The most powerful example is two young men who created California Cooler in a barn and sold it to Brown Foreman for a reported $145,000,000. How small do you have to be to be 'small' and profitable? Fifteen years ago, early in our wine career, we hired Louis Gomberg as a consultant. In those times, he counseled us to aim at 25,000 cases maximum/year. He warned of a no-man's-land between 25,000 and 200,000 cases/year where one was too big to sell personally and too small to carry the costs of national marketing.

Today the efficient small winery might be 50,000 cases/year, but no larger. If there is to be any winnowing, it will be among the clumsy in all sizes, the opportunist who makes a mistake, the winery that elects to grow into no-man's-land and does so with no special advantage, no special market affiliation that can sustain good pricing and keep marketing costs to a level near that of the small winery. Discount prices during a bull market are not a special advantage long-term.

4. Negociants—if you own a coastal winery and a vineyard, you have $111/case invested in fixed capital. You could have started a vineyard (four years plus $8,000–$12,000/acre to develop, plus land at $5,000/acre). Your own winery cost $34/case. Your total investment to build is within the range from $22/case to $46/case. On top of this are operating costs and product inventory. That is $7,000/ton or $111/case.

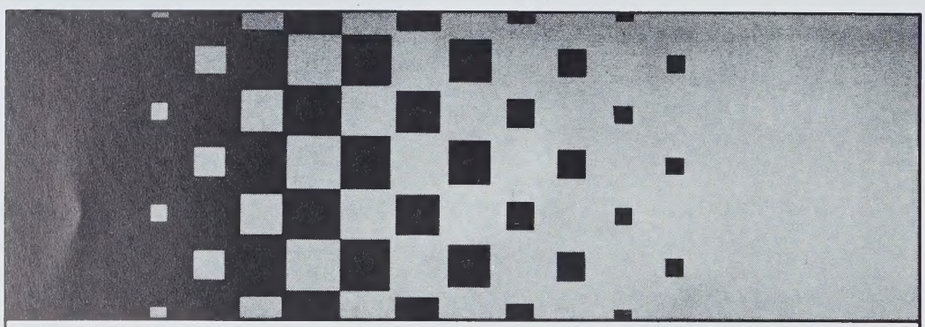
Tony Cartlidge, Pat Dore, Thomas Manning (Chateau Diana), Georges DeBoeuf, et al, do not invest the $111/case. Who does? Who will? Who should? Anyone? Why not everyone be a negociant? It is the smart way to go when one is convinced surpluses are eternal. But what has it to do with the U.S. wine industry?

In my view, it is the salvaging function the wine negociant performs, a function that exists in all industries. It is basic, inevitable, always a part and only a part, usually a small part of the industry; very economically strong, often very profitable, but the salvage industry is not the steel or plastic or wine industry. It is a special industry to be handled only by very talented people who know how to buy and sell on the margin with speed and a great deal of confidence and derring-do. The comments of the negociants on the U.S. wine market and their skills of wine marketing are just that, a wine salvage operator's view of his world.

5. A tip of the hat to the new breed of negociant who saw the tremendous capital costs of the industry and adroitly avoided them, and to Acacia and Vichon who, like General George Patton, moved so well and fast that they got ahead of their own newsmaking segments of the market. But there have been other forces in the news recently.

The Wall Street Journal story 'Tough Times, Wine Industry Finds It May Be Its Own Worst Enemy' and *The Wine Spectator* story (March 16–30, 1986) on New York vineyard problems each have a negative theme, in my view similar to the *PW* column. The California North Coast Grape Growers Association continues their efforts to fragment the wine industry.

I've read the stories several times. I've obtained copies of the Winegrowers of California Connecticut Test Market (Julia Child) and the Oxtoby-Smith report. CAWG (California Association of Winegrape Growers) just distributed The Gomberg Report for year-end



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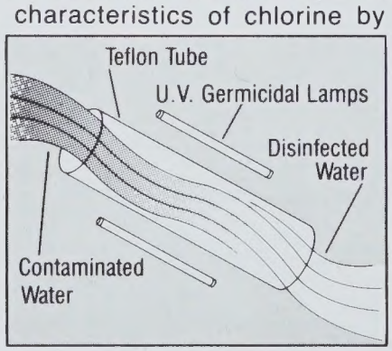

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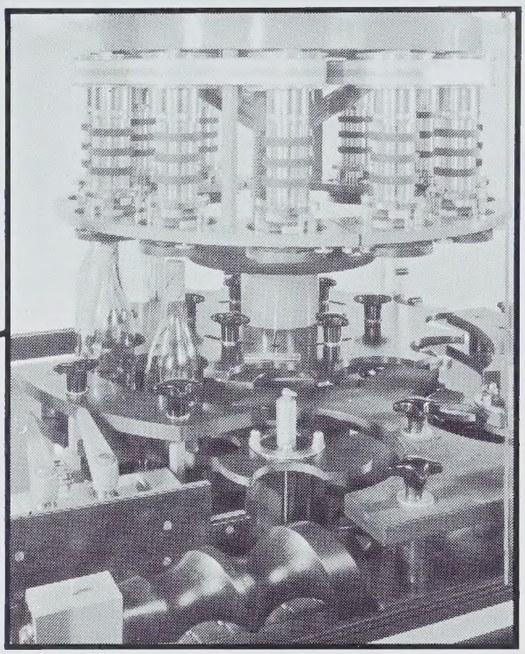

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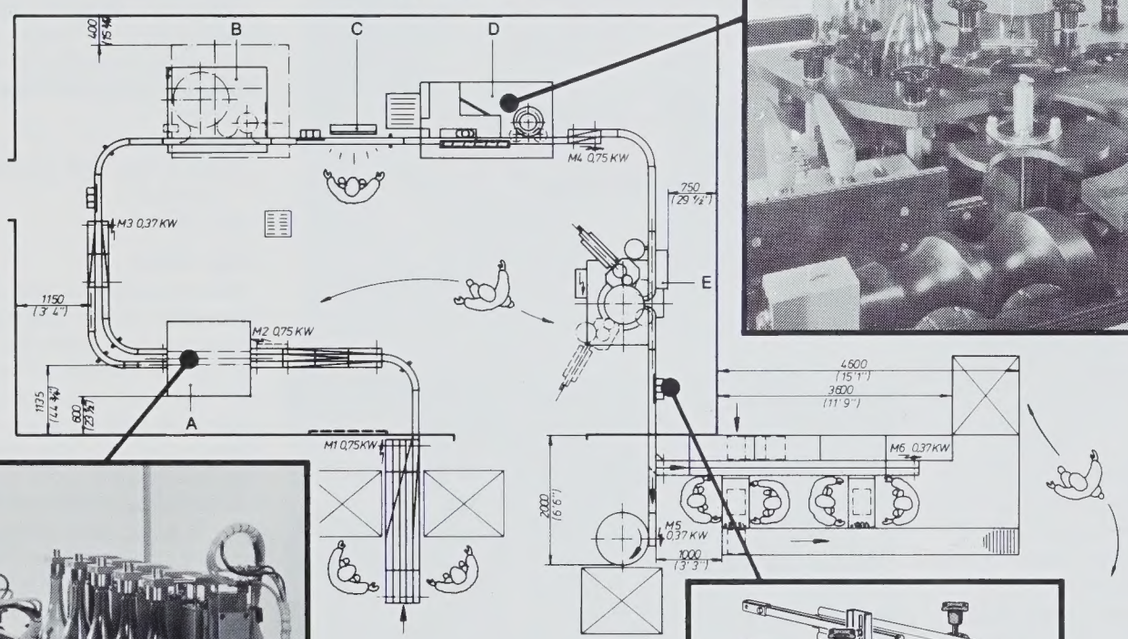

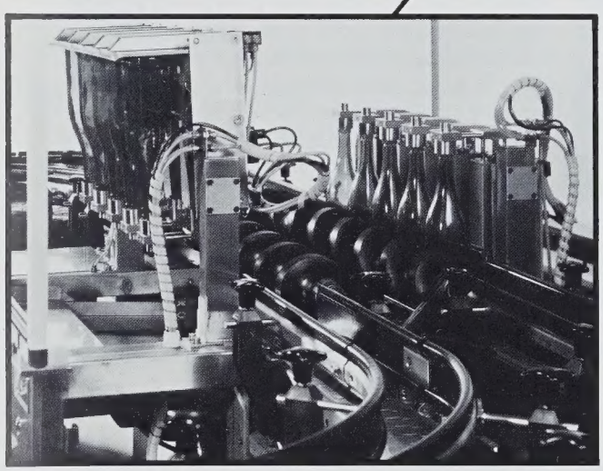

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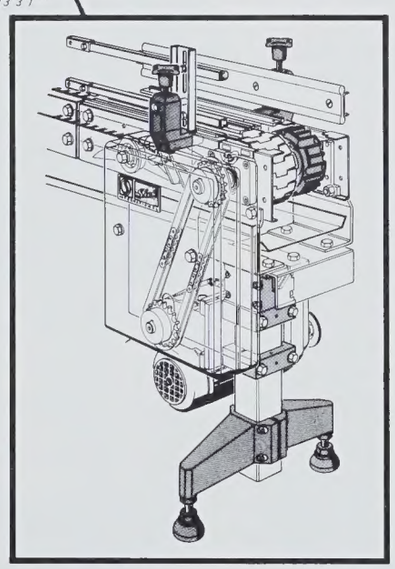

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1985. In this report, five small wineries were cited that grew 33–57% in 1985. George Schofield, in *PW*, at CAWG Grape Day (UC Davis), and at various seminars, provides excellent data, very accurate.

Schofield sees the raisin situation as the prime and only concern to winegrape growers and to stability in the wine marketing field. The absolute need to separate wine from the distilled spirits industry is now being addressed and it will succeed. When one looks at only one or two articles, one can feel bullish or bearish on wine in the U.S. In my view, the bullish articles are the strongest.

This whole big-vs.-small winery and the negociant thing may not really be where the action in our industry is, anyway. Five companies out of 620 wineries produce and sell over 75% (some say over 80%) of the wine made in the U.S. It is their position and problems that will determine the financial health of grape growers and the wine industry. The men and women who put in the time and pay their dues through CAWG, the Wine Institute (Leon Adams and Lou Gomberg have certainly put in their time and paid dues for a lot of us) and the Winegrowers of California (the vehicle for the wine marketing order) will determine what the industry will be and will provide the energy to feed the wine market. All other comments and actions are peripheral.

Sincerely,
Bob Polson
Vineyard & Winery Owner, Farm Manager
Healdsburg, CA

Dear Editor:

A couple of comments about the article on canes vs. cordons (*PW*, Sept/Oct 1985). All of your grower/contributors seem to complain about reduced yields with Chardonnay on cordons. Well, first of all, nobody mentioned the heat-treated clone which will easily crank out 5 tons/acre, even here in Carneros. Yields of 7–9 tons/acre are not unheard of. We have been able to get 5 tons/acre even on the old, less fruitful clone with some extra buds. In short, canes may be necessary in the Alexander Valley, but in less fertile conditions cordons are working.

One final point–another major reason to go cordon is the increased ease of mechanical harvesting (and mechanical pruning). How about a story on new trellis ideas that allow for more buds/vine (or more appropriately, more buds/acre) so cordons can be used on varieties such as Sauvignon blanc?

Sincerely,
Zach Berkowitz
Vineyard Manager, Carneros Ranch, Domaine Chandon
Napa, CA

Dear Editor:

Your magazine is truly an invaluable publication and I enjoy it very much. As a wine judge, I am especially interested in your presentations on specific tastings of individual varieties that are featured periodically. They are very informative and sometimes truly enlightening. Those of us who take wine tasting and judging seriously benefit from these types of articles.

I would make only one suggestion. Although you do have some introduction about the wine variety, it would be nice if it were more specific. In other words, I would like to see an explanation or description of what aromas, bouquets, flavors, etc., should be found in a typical wine of the stated variety. From my point of view, and several of my friends who subscribe to your magazine, this type of information would be extremely educational.

Once again, I thank you for your help and interest. Keep up the good work. Your publication is a winner.

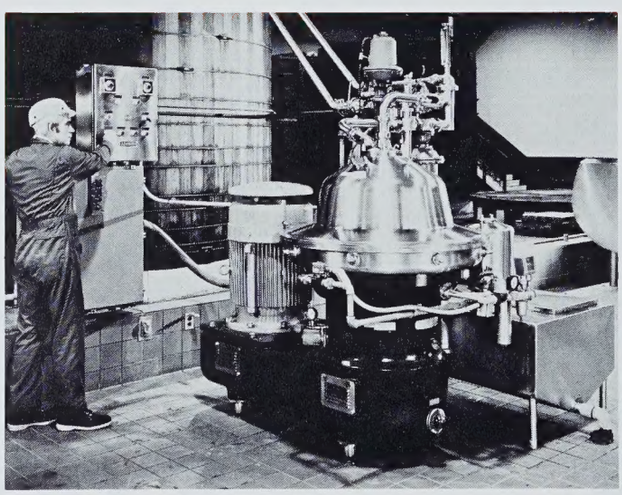
Sincerely,
Linda M. King
Butler, Pennsylvania

Dear Editor:

As a new vineyard owner, I received a gift subscription to *Practical Winery* from my son Robert. To be brief and to the point, it has been of the greatest possible help to our whole organization. Thank you for clear, lucid and to-the-point articles and illustrations. We all enjoy every issue and it is very dog-eared before it is consigned to the library.

Sincerely,
Robert E. Bidwell
Melville, Long Island, New York

The West Coast: It's Westfalia territory



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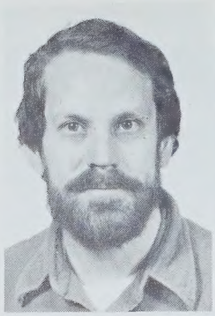

The Wine Retailer

Stan Hock

Let Them Drink Wine

In August 1984, California issued a Wine & Winegrape Marketing Order to help its wine industry combat an alarmingly flat market for California wine. The Marketing Order enabled the Winegrowers of California, an unprecedented coalition of 5,000-plus grapegrowers and about 650 vintners, to levy assessments on all its members, in order to finance a wide-ranging program with the following aims: to preserve and expand existing markets for California wine and devise strategies for creating new ones; to educate the public about the value and diverse uses of wine; to fund research, including market analysis and product development; and to lobby on behalf of California grower/vintner interests in domestic and international forums.

Armed with a sweeping mandate and a hefty budget—$4.4 million in fiscal 1984/85 and $6.4 million in fiscal 1985/86—the Winegrowers set sail with high hopes.

After 19 months of operation, however, the wolves are at the door. Critics in the industry charge that the Winegrowers have little to show for the millions they've expended, and it is quite possible that disgruntled growers and vintners may vote down an extension of the Marketing Order when it comes up for renewal in 1987.

In a recent speech, Robert Mondavi directly criticized the Winegrowers: "I know it takes time to organize and establish an overall program for the wine industry," Mondavi said, "but, unfortunately, the growers and vintners have lost valuable time and not realized the damage being done to everyone concerned. This program, which we need so desperately, has been too slow in coming.

"Also, the Winegrowers appear to be placing their main efforts on the 'present regular consumers' of wine and they are not concentrating properly on the portion of the public who do not yet consume any wine."

The portion of the American public "who do not yet consume any wine," or consume very little, is frighteningly large, and this is the basic fact that is preoccupying the California wine industry these days, as it struggles to regain lost momentum. This message is confirmed by grim statistics documenting a shrinking wine market, which continue to roll in and drive the final nails into the coffin of the 1970s 'wine boom'.

As a result, California wineries cast about for ways to entice the 'infrequent user' of wine to consume more of it and the 'non-user' to join—and enlarge—the club. Consequently, much of the rhetoric one hears in the wine trade these days concerns the need for creative new marketing initiatives.

Carolyn Martini sounded this theme to a wine trade gathering recently: "Our goal, first and foremost, is to sell American wine to American consumers," she said. "We have, to date, accepted very traditional ideas of wine styles, types, qualities and packaging from the Europeans, and we constantly look over our shoulders, even now, for their approval. Who cares what the French think? We're trying to sell wine to Americans."

Selling wine to Americans, however, is no easy task. As Martini well knows, the average American consumes about 40 gallons of soft drinks each year and almost as much beer. By contrast, our per capita wine consumption is stalled at 2.4 gallons (and perhaps actually declining, if wine coolers are omitted from the calculation), about 10% of what Italians drink each year. So, it's one thing to talk about feeding wine to the peasants, but—in a beer-swilling Anglo-Saxon culture—how do you actually do it?

Based on recent conversations with leading producers and marketers, here are some of the answers that are blowing in the wind.

Product: "If you want to reach these [non-wine-drinking] people, you've got to consider any product that appeals to them," Carolyn Martini told me, "and accept it all with pride." What this seems to mean is that the premium end of the trade, with an eye on the wine cooler phenomenon, will continue to court the vast beer/soft drink market with an ever-expanding production and promotion of low-alcohol, slightly sweet blush wines and will also continue serious research into dealcoholized wine.

In 1985, wine coolers represented over 16% of all wine depletions and over 11% of retail wine sales. Although industry analysts disagree over whether the cooler craze presages another wine boom, the fact is that coolers have almost singlehandedly bailed out California's beleaguered grapegrowers. Coolers are also responsible for enticing millions of young beer and soft drink consumers to sample a winegrape product. These are developments the premium end of the industry is not about to ignore.

Nonetheless, the cooler market is essentially a world unto itself and it is also rapidly becoming the province of big boys like Gallo, Seagram's and Heublein. So premium wineries craving access to the Miller Time and Coors Country crowd must pin their hopes on the rising popularity of a kindred beverage like blush wine.

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Carolyn Martini cites the appeal of white Zinfandel as an example of how traditional table-wine producers can tempt nonusers into the wine market: "It's pretty, inexpensive, low in alcohol and the stuff tastes good. Bingo." In 1984, her family's winery, Louis M. Martini—not exactly known for jumping on bandwagons—began producing white Zinfandel, and the 13,000 cases it made in 1985 have quickly sold out. "If we can do it," Martini joked, "it must be respectable."

Of course, 13,000 cases is mere topping wine to Martini's neighbor, Sutter Home. In 1985, Sutter Home produced 1.5 million cases of white Zinfandel (including 200,000 cases in 187mL screwcap bottles), plus another 200,000 cases of Sparkler, a sparkling white Zinfandel. In 1986, according to Alex Morgan, the winery's western regional sales manager, those figures should escalate to 2.2–2.5 million cases of white Zinfandel and 350,000 cases of Sparkler, and Morgan envisions a day when the winery might actually produce and sell 6–7 million cases of white Zinfandel a year. And Sutter Home is hardly alone in the field.

Although white Zinfandel continues to dominate the burgeoning blush wine market, the success of the style and escalating prices for Zinfandel grapes have prompted many producers to turn to other varieties. Fetzer Vineyards produces 100,000 cases of white Zinfandel under its Bel Arbres label, but it also makes another 50,000 cases combined—also Bel Arbres—of white Cabernet, white Pinot Noir, and white Merlot. Pedroncelli is marketing its new Sonoma Blush wine, made from Pinot Noir and Gamay grapes, as the 'Un-Zin' blush wine, perhaps ushering in a new era in which California winemakers, having successfully liquidated their big Zinfandel surplus, try the same approach with other under-appreciated varieties.

The other area of product development to watch is dealcoholized wine. Although the initial commercial offerings have been disappointing—because they lack distinctive wine character—new technology is being brought to bear on the problem. The Winegrowers have funded Dr. Richard Carey of California State University-Fresno to explore the technical

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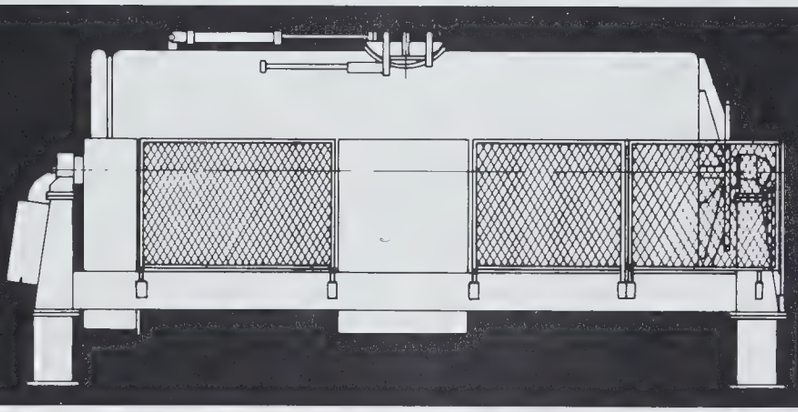

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feasibility of making high-quality de-alcoholized wine. J. Lohr Winery in San Jose produces a de-alcoholized wine as well. Given America's current anti-alcohol/pro-fitness mood, so successfully exploited by the wine cooler producers, don't be surprised to see a new generation of de-alcoholized wines storm the market soon.

Packaging: The name of the game here is clearly the 187mL screwcap bottle. Designed originally for airline service—750,000 cases of wine in this size were sold on airlines in 1985—wine marketers now see this easy-opening, 'single-serving container' as another effective way to tap into the beer and soft drink market. "The package is here to stay," says Alex Morgan of Sutter Home. "I think 187s will accomplish for off-sale what wine-by-the-glass programs did for on-sale."

Carolyn Martini concurs. Suggesting that its packaging is one of the main things Americans find 'intimidating' about wine, she cites the "portability, accessibility, and friendliness of beer," and asks, "If you're not a regular wine drinker and you're confronted by a 750mL bottle of wine, how do you know how much is safe to drink?"

More than 50 wines have been bottled in 187mL screwcaps. Any qualms about the quality of a screwcap seal seem to have been dispelled by German research purporting to prove that, for short-term ageing at least, screwcaps provide as good a seal as corks do.

Promotion: In November 1985, the Winegrowers of California released the results of the Oxtoby-Smith study, a much-discussed $275,000 market survey of 1,176 adult wine drinkers (defined as those who drink at least one glass of wine/month). Although the industry has tried to put a good face on the results, many of the study's findings are causing producers deep concern.

Most significantly, Oxtoby-Smith found that the vast majority of American wine drinkers have little or no interest in learning more about wine, nor do they pay much attention to wine advertising, articles, or books. Basically, they just want wine that tastes good, goes well with food and is a good value, and they rely primarily on the advice and guidance of friends and retailers to obtain it.

Naturally, this raises the question of how the wine producer and marketer can best reach and influence this apparently uninterested American wine consumer. Since Oxtoby-Smith indicates that costly direct advertising is almost useless (except for giants like Gallo), California wineries may need to concentrate their marketing efforts on promotions in restaurants and retail shops.

Along these lines, we'll undoubtedly be seeing even more emphasis on wine as a 'food beverage'. (The Europeans sure must get a good chuckle out of this.)

For instance, David Hansmith, of Fetzer Vineyards, says that his winery's major promotional efforts now consist of "grass-roots food and wine programs," and, to emphasize this, the winery is developing an 8-acre model garden which will display 1,200 varieties of fruits and vegetables.

"The real hope of the industry," Hansmith maintains, "lies in tying wine to the 'good food' phenomenon, moving it out of the liquor department and into the grocery section." As wineries try to inculcate this idea, we can expect to see more winery-generated food/wine promotions, such as 'meet the winemaker' dinners, wine/food compatibility charts, wine cookbooks, etc.

Distribution: Carolyn Martini stresses that "folks can't buy wine if it isn't where they shop and not in a form they can use." Thus, the Trade Barriers Committee of the Winegrowers of California is funding a major campaign to eliminate the vast tangle of laws, taxes and tariffs that inhibit the free flow of California wine throughout the country and the world.

Since the repeal of Prohibition, the wine industry has faced a crazyquilt of state regulations, excise taxes and advertising bans that have seriously hampered its ability to effectively market its product. Removing these barriers would go a long way toward facilitating an expanded wine market.

Still, such obstacles may take decades to hurdle, and, as Robert Mondavi says, the wine industry needs results now. When all is said and done, it's up to the people making the wine to sell it to the American people. As Carolyn Martini said: "We are infants. We have barely begun to consider the possibilities of marketing wine in this country."

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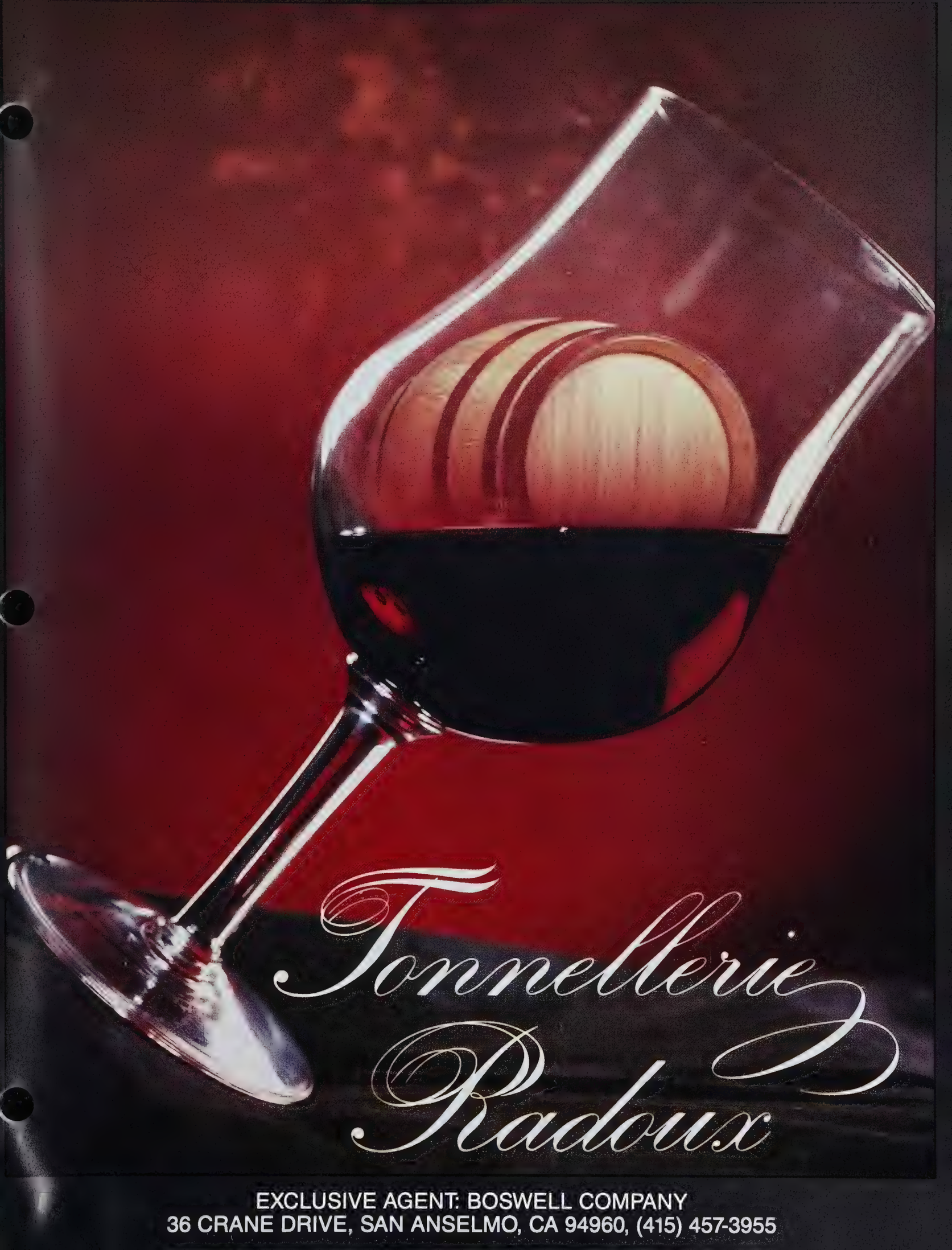

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The Wine Lawyer

R. Corbin Houchins

Regulatory Simplification

By the time this issue is in print, wineries should have received copies of official notice of rulemaking #584, published in the Federal Register on March 7, 1986. If you attended a BATF seminar recently, you may also have received a bit of a sales pitch for it.

That issue of the Federal Register should probably be saved as a collector's item, since it represents a serious proposal by the Bureau to reduce the number of regulations affecting production and sale of wine from 450 to 225, cutting verbiage by 65%. While most of the reduction reflects reorganization and condensation of material rather than a lower level of governmental regulation, there are some substantive changes.

Less Frequent Tax Returns

Most wineries pay only a small amount of gallonage tax. If the BATF proposal is adopted, those paying no more than $500/year (equivalent to 2,941 gallons of table wine) may pay annually, and those paying no more than $5,000/year (29,411 gallons) may pay quarterly. Moreover, the deferred tax bond coverage of the basic operating bond will be increased from $100 to $500, filling a gap in the regulations which formerly required consent of surety. Thus, wineries with total deferrals of no more than $500 for the combined two greatest months would be able to operate with only the Form 700 bond.

For that reason alone the proposal would deserve support. In these days of tight budgets and pressure to make ruinous (and probably revenue-negative) increases in gallonage taxes, a change that would make the government wait longer for its money represents a considerable commitment to making life a little easier for small operators. You can register your comments on the proposal (including your own proposals for further or different changes) by writing to Chief, FAA Wine & Beer Branch, BATF, P.O. Box 385, Washington D.C. 20044-0385, for receipt by July 7, 1986.

Fewer Forms

There is more to the proposal than tax deferral. For example, production of sparkling wine would no longer require filing a formula. Also, the recent trend to eliminating forms is continued. Of the 14 now in use, eight would be eliminated.

Unfortunately, elimination of forms is not necessarily reduction of paperwork. It makes little difference to the red tape burden on your business whether you use a preprinted form or create a mandatory record you would not otherwise bother with on a plain sheet of paper. The *reductio ad absurdum* of that kind of 'paperwork reduction' is Form VI1, which you must create yourself from instructions supplied by the government. Still, the net effect of the forms elimination trend is positive and reflects a helpful attitude on the part of our regulators.

An Unrelated Change

Not all forms developments are so understandable as those proposed in notice #584.

By now you have probably learned that the new label approval form that was scheduled to go into use on the first of this year became mandatory on April 15, 1986. Since some local BATF offices obtained their supplies only well into March, for a time it seemed as if label approval depended on an underground source of a suppressed document. However, since the Bureau will accept duplex (*i.e.*, two-sided) photocopies of the form, there is no reason to hoard. Interestingly, the date of approval of the form by the Office of Management and Budget was February 29, 1986; a work day that is both late and fictitious may confirm some prejudices about the federal government.

More helpfully, since the first of the year the Bureau has been accepting photocopies and printer's proofs of labels, rather than production labels. That considerably expedites label approvals for wineries with powers of attorney on file, since a label can be telecopied to a correspondent in Washington, who signs Form

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5100.31 as attorney-in-fact, attaches the telecopy and hand-carries it to the Bureau. Formerly, that procedure worked only for informal approval, with formal approval waiting until a production label (or at least a full-color comp) was available.

New Regulations

Some material will be added by the proposed recodification, and as with the deletions the word count does not correlate with intensity of regulation. In several instances, new regulations amount to codification of rulings that interpret or fill in gaps in the published regulations. As a result, about 90 government circulars can be phased out.

The process of adding rulings to the regulations merits comment, because it illustrates a process that should be well understood by anyone in a business as heavily regulated as the wine industry. If I had to pick a single message from these columns to telegraph to everyone interested in the legal end of the wine business, it is that there are a lot of state and federal regulations, and they do not all mean what they say. Knowing what is in the regulation is not the same as knowing what is or is not legally possible.

An extreme example of that principle is the regulation that requires you to do something that is illegal under another set of laws which the people administering the regulation have no duty to know about. A more frequently encountered situation is where the regulation is just wrong-headed in a particular situation, with a consequence (usually for a smaller producer) that obviously could not have been intended.

Regulatory Precedents

The Bureau has a pretty good record in the area of dealing with regulations whose literal application would work a pointless hardship.

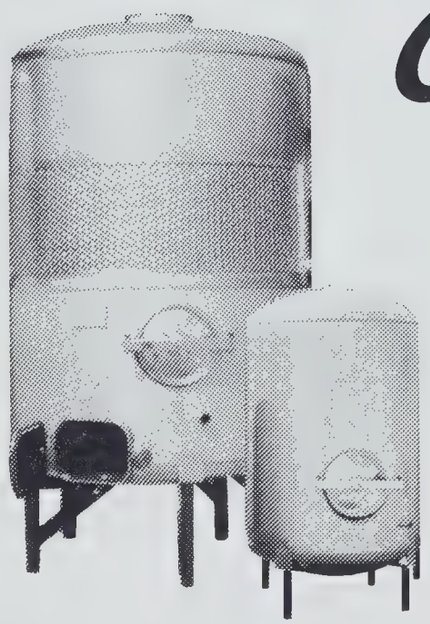
The process is aided by the fact that federal wine regulations themselves contain provisions encouraging industry members to ask for variances. Over time the variances become rather like the common law created by courts—because something is regularly done, it is effectively part of the law, although not found in the statutes.

The currently proposed recodification will write some of that common law down. For example, the procedure for rotating winemakers in a single facility would be put in a regulation. Nevertheless, development of interpretations and variances through experience will not cease upon adoption of the new rules. No one can draft written rules that foresee every contingency, so my constant refrain will continue to apply after the recodification: Ask for what you want, and don't necessarily take no for an answer.

Other Pending Changes

There are a few other federal regulatory straws in the wind.

In a recent column (*PW*, March/April 1986) we reviewed the strange history of the ingredient labeling regulations, which are working their way through the judicial system. As most in the industry are aware, there is a separate proposal for label disclosure of sulfur dioxide of 10 or more ppm. The comment period for that proposal expired late last year, so the shoe should drop before long. We also expect to see a decision soon on the Bureau's postponed 1983 regulation regarding the use of geographic names on wine labels otherwise than as an appellation of origin.



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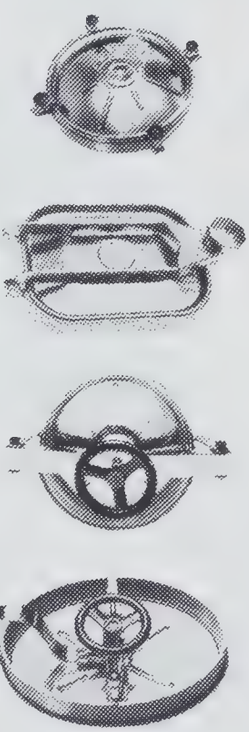

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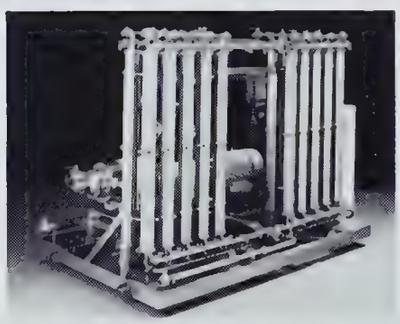

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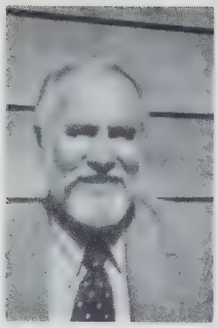

Winery Water & Waste

D.R. Storm, Ph.D., P.E.

Drainage

Down the Drain

Drainage functions for wineries usually fall into two categories. Within the winery structure, floor drains for tank, barrel and bottling spaces are generally connected to the sewer system and co-mingled with sanitary waste for eventual biological treatment and disposal. Wineries often choose the design option of separating sanitary wastewater from process wastewater by using sewer systems and treatment-disposal systems which are independent of one another. (Advantages of the latter plumbing option have been discussed in detail in previous *PW* columns.)

The second major drainage component is generated at outdoor, uncovered work spaces that can receive process waste drainage, storm drainage, or both, depending upon winery location, time of year, and climatic zone. For the southern or southeastern U.S., the not-infrequent afternoon summer and fall rain squalls could add a significant volume of excess drainage water to the process wastewater stream.

The driest region I have encountered in my work with wineries is the Temecula grapegrowing area in northern San Diego County, CA, where the long-term average annual rainfall is only some 12.5 inches. Wineries are popping up in Texas, New Mexico, and Arizona, but for these very arid parts of the world, only infrequent tropical storms with names like Julie, Hazel, or Ingrid will have to be reckoned with in the design of drainage facilities.

To decrease hydraulic loading on the winery's wastewater system, the 'uncovered' drainage network should have a diversion valve feature so that seasonal rains could be shunted to a drainage ditch or related element of the purely stormwater system.

1996 Years of Drainage Technology

During the reign of the Emperor Augustus (ca. 33 B.C.), his son-in-law, Marcus Agrippa, was credited with the construction of the most famous drain in history, the Cloaca Maxima (Heilbrunn, 1979). The Romans really had a fascination for things related to water and drainage, and their worship of a deity, Cloacina (the Drain personified), was certainly a demonstration of that intensity of spiritual interest (Ibid. 1979). The Cloaca Maxima, completed in 8 B.C., still functions today. The three-tier, stone arch construction for the drain was the trademark of the engineers and stonemasons of that era.

The same hydraulic principles that guided the Roman drainage engineers are still valid today. Materials of construction have changed, however, and a broad array of suitable drainage pipe materials and appurtenances are available to fit a variety of drainage requirements, soil and climatic conditions.

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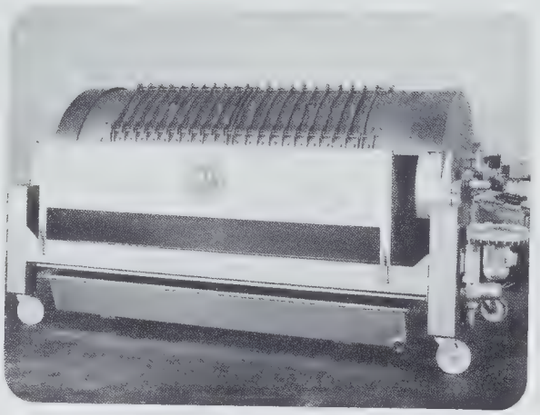

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Strainers or Screens (or Both)?

In-winery drains can contain a number of special plumbing details that can either be a blessing, an operation and maintenance nightmare, or a gross waste of the owner's capital funds. Many wineries have so-called 'basket strainers' placed strategically in the floor drain system. The logic for installing these devices is to trap the larger solids that may originate in the crush/press or fermentation tank work areas. In theory, this could prevent small feeder drain blockage from a collection of stems, seeds, skins and grape leaves and reduce an unwanted increment of solids that the waste treatment system is incapable of handling.

In practice, what generally happens is that too often in the long-hour, tired-crew situation that prevails during the period of highest seed/stem/skin generation, the basket strainers often are not serviced frequently enough. If they are, the exhausted crew member with the good intention of clearing the drain will pull the basket and discharge the accumulated contents to drain, totally defeating the purpose of the device and its function.

The gravity screen or its high-tech sister, the rotary drum screen, are used successfully by both large and small wineries to achieve the same goal as the basket screens. Some even have both installed, but it seems to be an unnecessary luxury, unless the winemaker or winery architect happen to subscribe to the ultra-conservative 'belt and suspender' school of drainage philosophy.

Drainage Engineering

Drainage in its broadest definition crosses many scientific disciplines. The drainage details of concern to wineries only form a small segment of the drainage engineering specialty. Agricultural and irrigation engineers are, by their education and training, specialists in the field of drainage. Whether it be subsurface drainage of soil with a high water table or the subsurface drainage of alkaline soils laden with salts that are harmful to irrigated agriculture, the largest drainage projects world-wide, in terms of engineering effort and dollars expended, are in the field of agriculture.

Urban drainage is a problem unto itself in terms of the pollution potential created by the runoff from paved, urbanized areas. The constituency of street drainage and parking lot runoff has been characterized by many investigators and found to be on the average as contaminated with pathogens, toxic materials and dust/litter as raw, sanitary sewage (Anon. 1972).

For wineries, the runoff from paved areas can be dealt with in a number of ways so that pollution and hydraulic loading can be minimized. First, if there is an area set aside for vehicle maintenance (fork lifts, tractors, trucks, etc.), the crankcase oil, fuel, and lubricant residuals can be directed to a commercially available oil/grease trap to prevent their uncontrolled discharge to nearby natural drainage courses.

Second, the conversion of bare soil to pavement usually doubles the volume and rate of surface runoff from each unit of area. Porous pavements consisting of specially designed concrete blocks can reduce the runoff potential from paved areas and allow a 15–20% increase in infiltration of rainfall over the bottle-tight asphalt or concrete paving.

A third consideration is the diffusion of drainage rather than the classic concentration of drainage and storm waters from smaller to larger pipes in a flow network. The diffusion of surface runoff with discharge over a wide area allows more physical filtration by grass or other vegetative cover and gives a greater opportunity for infiltration and more physical and biological purification as the runoff passes through the soil mantle.

This might require several grade/slope breaks in one given paved or parking area. Such construction practices are not that much more expensive, if at all. There is, as a consequence, less soil erosion as the lower-volume, diffuse flow has less energy to pluck soil particles from the surface. Trying to de-energize the concentrated flow that might result if all your runoff was routed to a single large pipe is a formidable task.

Problem-Solving

There are commercial enterprises that have been in the drainage pipe and structure business for nearly 60 years and their handbooks on drainage design are usually available for the asking. It might be well to have an array of manuals and catalogs on the subject so that you can familiarize yourself with what is available and what purchase prices might be. (Armco Steel Company used to give the civil engineering graduates of small universities a copy of their drainage handbook much in the same way that pharmaceutical companies give graduating physicians a gold-initialled doctor's bag.)

While it would be very helpful to conceptualize the drainage system and pipe network for your winery expansion or a new winery in the planning stage, it would be essential to eventually seek the design assistance of someone who has a good knowledge of hydrology, open channel hydraulics, and drainge design. This would preferably be someone who is certified in your particular state to practice civil or agricultural engineering. Often, the U.S. Soil Conservation Service offices have specialists in drainage and soil erosion prevention practices. While they are not in a position to certify a design or prepare construction drawings, they can be a valuable resource in bringing the total drainage-soil-runoff package together.

Can You Top This!

Some 20 years ago, my wife and I attended what constituted then a 'yuppie' dinner party in Marin County, just north of San Francisco. One of the then-yuppie wives was regaling the accomplishments of her young physician spouse when she described a special surgical device which bore his name, the 'Miller Clamp' or some such thing. My wife, whose Irish sense of humor is always looking for an audience, said, "Well, that is a great professional achievement, but my husband is really well-known in the drainage field—you have heard of Storm Drain, haven't you?"

David Storm is a consulting sanitary engineer and owner of Winters Winery in Winters, CA.

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Strategic Business Plans, Part II

Judy L. Mickle
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Within the wine industry, business plans will vary from one winery or vineyard to the next depending upon the intended use of the business plan. For example, a plan written to obtain financing for the construction of a warehouse facility would focus the bank's attention on projected cash flows. You would describe the amount and structure of financing you are seeking, and show very specifically how the funds would be used, how their use would affect your financial results over the next several years and, most importantly, how you intend to make interest payments and repay the loan.

On the other hand, a plan written primarily for internal purposes would concentrate on organizational structure, defining areas of responsibility and discussing operational plans for the various departments which are consistent with the overall strategic goals of the winery or vineyard.

All business plans, however, should be honest analyses based on realistic assumptions. The assumptions and projections should be well-researched and documented by reference to sources of information. The plan should be complete and include discussions of strategies for taking advantage of unexpected opportunities and for overcoming potential problems. Finally, it is important that the plan be concise and consistent.

The following is an outline of the major topics in a business plan and a brief description of issues to examine in discussing each topic.

1. Summary Your business plan summary will tell who you are, what you are trying to do, why what you have to offer is unique and, most important, why the plan should be evaluated. The summary should lead the reader through the plan by highlighting the major topical areas you will later be discussing in detail: the company, the types of wines or grapes produced, the area of the wine market you are targeting, management structure, and information on past financial performance and future projections. If the business plan is intended to raise financing, you will want to include in the summary the amount, uses and terms of financing sought. Finally, your summary should be *brief* (one or two pages). You will probably find it easiest to prepare after the rest of the business plan is complete.

2. The Business This section will introduce the winery by describing the winery founders, when the winery was founded and the principles and values upon which the winery and/or vineyard has been operated over the years. When presented in the context of what your present goals are, it should be clear that the goals are either a continuation of what has worked successfully in the past or whether the goals are well-thought-out solutions to problems which have developed over a period of time.

For example, XYZ Vineyards was founded in 1957 by two graduates from UC Davis who currently run the operation. In

the past, they have been highly successful, due primarily to viticultural innovations which have led to higher sugar levels, more resilient vines, etc. They are seeking a $200,000 term loan to enable them to adopt new vine spacing methods.

3. The Product Include in this section a full description of the varieties and quantities of wine or grapes you are producing or plan to produce. Analyze the competitive advantages and disadvantages of each product. Include information on what your present product mix is, what changes, if any, you intend to make with that mix and what the effect of the change will be to your operating results. This can be most effectively done with reference to the costs and margins as well as customers and projected sales for each variety. We will discuss some of the techniques of putting together this sort of financial information in Part III of this series.

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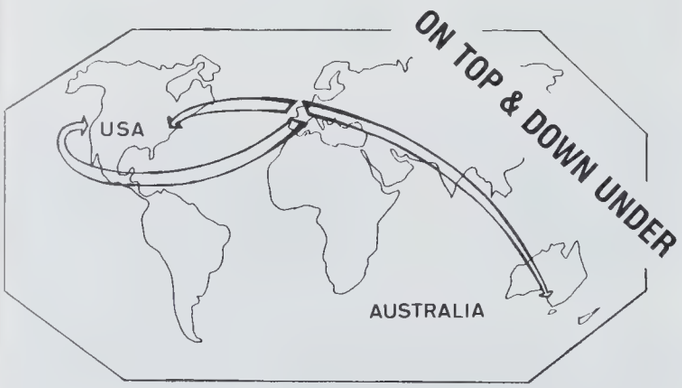

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4. Industry Analysis An industry analysis will set the stage for the marketing sections which follow; therefore, it is important to document the information you have gathered in some detail. Include information on the current level of wine industry production, particularly in your geographic area, and projected sales trends in the various market places. Identify competitors to the industry, such as wine coolers, distillers, and breweries, and competitors to you specifically, such as other wineries.

Assess the strength of competition. A good indicator of whether the level of competition can readily increase is the level of cost required for someone to come in to the industry and establish themselves. Government and economic trends are obviously very important, as are the roles of innovation and technological change.

5. Market Analysis This section gives you a chance to demonstrate your winery's opportunities for achieving its goals in its targeted markets. Basic to the market analysis is a clear and in-depth description of what your market is. Selling wine may sound like what you're after, but by being more descriptive about who you are trying to sell wine to and what wine, in particular, you are trying to sell them, you focus your time, energy and money in the right direction.

The market analysis, then, should start with a description of your target market. This will include information such as size and growth (both past and anticipated) and trends in the direction of the market. It will include a thorough discussion of whom the competitors are in the market you are targeting, and their size, market share, and competitive advantages and disadvantages. It will be helpful for you to attempt to anticipate how your competitors will respond to any market strategies you develop. It is also very important that you have a clear idea of whom your customers are as well as their habits—where they shop, how much they buy and at what prices, and reasons for their purchases.

For example, you decide to target the premium end of the Chardonnay market. Based upon the research you have done, you determine that white wine, particularly Chardonnay, consumption is increasing and that, with the recent economic prosperity, the more expensive wines from boutique wineries are selling as well as, if not better than, more moderately-priced wines. You have identified your customer as someone who tends to shop in wine shops as opposed to discount liquor stores. He buys wine frequently and is willing to pay a premium for the wine that he likes. You plan to sell him Chardonnay for $20/bottle.

From the above analysis of competitors and customers, you will be able to project your sales (and market share) and profits by market segment and customer type.

6. Marketing Strategy The next important stage in the business plan is to plan your winery's *specific* marketing strategies for attaining the market share and sales goals you projected above. The marketing strategies will provide you with a clear plan for getting from where you are now in terms of sales and market position to where you realistically expect to be in one year, two years, five years. Your marketing strategies may include a change in your method of distribution, projecting a different character about your wine, advertising and promotional campaigns as well as pricing policies, to encourage new customers.

Appropriate strategies or combination of strategies should be thoroughly discussed. Show how the strategies are to be implemented, by whom, what could go wrong and what your contingency plans are. Once you have decided upon your projected level of sales over the next five years, the next step is to ensure that your production plans are consistent with the marketing plan and sufficient to meet your sales goals.

7. Production Describe the company's current production methods, capacity and capabilities in terms of both warehous-

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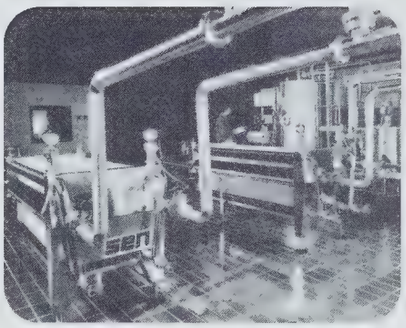

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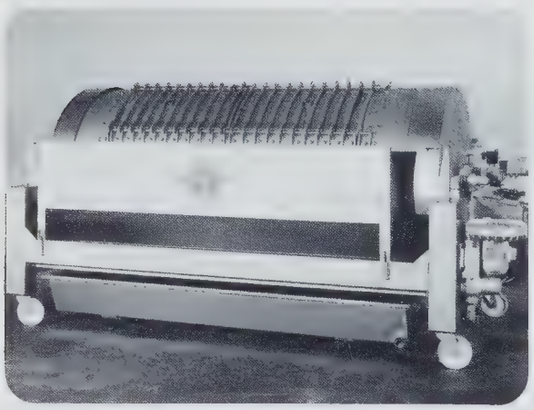

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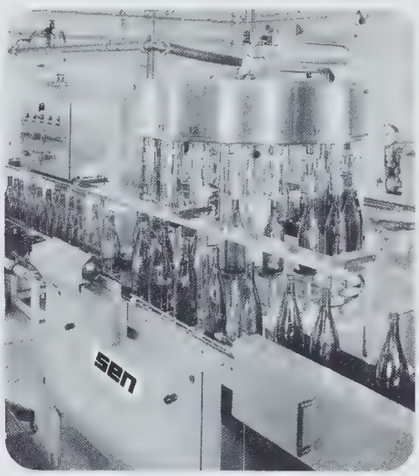

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ing and tank storage, equipment such as bottling capacity, and labor. If any idle capacity presently exists, this should be discussed to show how planned increases in sales (and therefore production) will use that excess capacity. If not, you will need to address what additions to fixed assets, storage capacity and labor will be required to meet your projected inventory needs. In the case of a business plan prepared primarily for obtaining financing for equipment, the production portion of the plan and how it relates to the market analysis and overall strategies is particularly important.

8. Research & Development In the wine industry, as in any industry, it is important to maintain communication in some form with academic institutions that generate the latest developments in viticulture and enology. Your business plan will be a more convincing document if you are able to show that you recognize the importance of technical information and are active and involved in groups that will give you access to that information.

9. Management & Organization Often, in a newly-developing business venture, it is the skills and talents of the individuals involved that provide the best indication as to the ultimate success of the winery or vineyard. Therefore, describe in your business plan key people, their strengths, and what they offer and will contribute to the business—education skills, prior experience. In addition to describing the individuals, show how the management team will be organized and what the philosophy of decision-making will be. It is important that the individuals, no matter how talented separately, be able to work together as an effective and cohesive team.

10. Implementation Plan Develop an implementation plan for each of the strategies that you have chosen above which integrates and coordinates all the key business areas identified: marketing, production, management, personnel, and financing. The implementation plan differs from the strategic plans in that it is a timetable for completing very specific tasks—either monthly or quarterly.

11. Potential Problems and Risks Finally, the business plan should fairly present and consider the difficulties you may encounter in the next two to five years as you attempt to implement your plans. This is a good time to play your own devil's advocate. In this section, discuss the critical risks of starting a winery, the likelihood of risks occurring and the potential problems which may delay or prevent you from going ahead with your plans. For example, what would be the effect of interest rates changing 2%, or the price of grapes declining 10%? What happens if consumer demand does not follow the patterns you have anticipated? For each risk discussed, outline plans to minimize its impact. For each significant problem identified, develop a strategy to overcome it.

* * *

Your business plan, if carefully and thoughtfully prepared, will be a clear statement of how you intend to accomplish the goals you have set for your winery. The final step now is to support your plan with a complete package of financial statements and projections to show in hard dollars the results of the plans you have laid out above.

In Part III, we will discuss the preparation of this financial package, tools and resources that might be helpful, and what to do with the business plan when you're finished.

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Braud Mechanical Harvesters Exported to North America

Viticulturists in Europe have long been familiar with Braud agricultural equipment. In 1985 the manufacturer began exporting equipment to North America. Two mechanical grape-harvesting machines were delivered, one to the Ken Dyck Vineyards near Niagara Falls, Canada, and one to Prince Michel Vineyards and Rapidan Vineyards in Virginia, both managed by Joachim Holerith.

The French term *enjambeur* best describes the new Braud. It translates roughly as 'straddler', allowing for Braud's multiple capabilities. The machine is primarily a mechanical harvester, but is highly adaptable. Using a set of fiberglass rods controlled by hydraulic valves, the harvester shakes the trellis; it does not batter the vines, thereby reducing potential wood breakage and damage to the vines.

At Prince Michel, Holerith reported that his Chardonnay came in 50% whole cluster with very few smashed berries. Riesling was harvested with an even higher percentage of whole clusters. The beaters are adjustable between 0–600 pulses/minute with a recommended operating speed of 450 pulses/minute.

The Braud 2714 has a 97-horsepower turbo-charged engine and a total hydrostatic system enabling the machine to remain level when on slopes. In addition, the Braud 2714 is able to adjust vertically by means of a sophisticated electronic system which controls the hydraulic valves.

A Model 2714 was delivered to Holerith for Prince Michel and Rapidan Vineyards in 1985 to harvest an eventual 160 acres when in full production. This includes 110 acres at Prince Michel and 50 acres at Rapidan, which are a short driving distance apart. Riesling is planted with 1,200 vines/acre and yields 4.5–5 tons/acre. Chardonnay, with 1,460 vines/acre planted on 1.05m x 2.6m, will ultimately produce 4–5 tons/acre. In 1986, they expect a 2.5–3 ton/acre yield from 4-year-old Chardonnay vines to be harvested at an average speed of 1.5 hours/acre.

Braud spray unit operating in vineyard.

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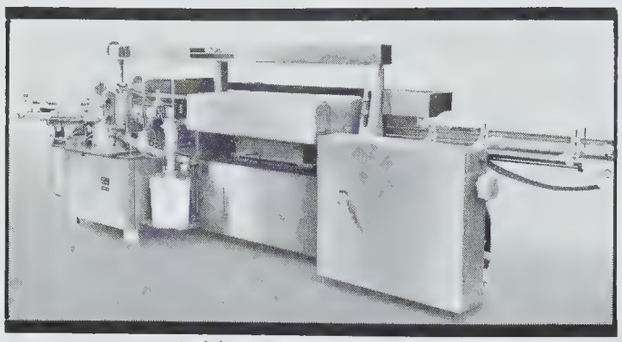

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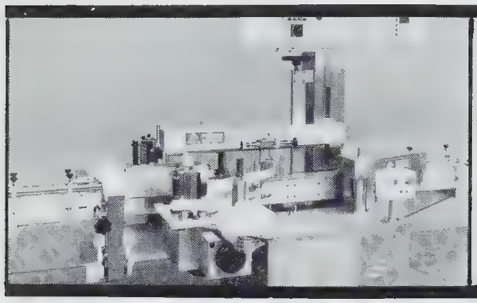

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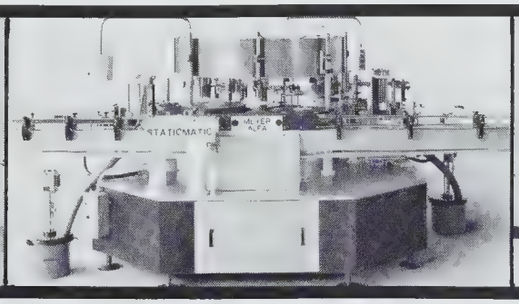

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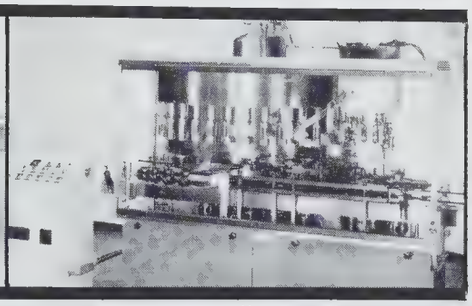

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White grapes are ready to harvest at the middle to end of August. Thirty-five acres of Cabernet Sauvignon, Merlot and Cabernet franc will be picked between the middle and end of September.

Ken Dyck used a model 2714 to harvest approximately 200 tons of various grapes from his 75 acres, where the oldest vines were in seventh leaf. He observed 40% whole clusters of Riesling in the gondola after harvesting and 95% whole clusters with Elvira grapes. He harvested 13 tons of Seyval from one acre planted with 760 vines in one hour. Dyck also harvested 125 acres belonging to other growers, which yielded 250 tons total.

The machine is multi-purpose, 'all-seasonal'; it will spray and hedge as well as harvest, and carries multiple side-hoes. The harvesting head, including grape-holding tanks, can be removed by one man with one tool in less than 30 minutes.

Four spray-units fed from two 1,450-liter tanks can spray the straddled row and near sides of each adjacent row. Holerith applied five sprays during the 1985 growing season at an average operating speed of 4.4 mph. A micro-computer controls the spray volume to compensate for the ground speed. Each spray unit has eight nozzles available to emit over a 2-meter maximum vertical range. Each nozzle direction is adjustable and can be open or closed to offer deep penetration at the optimum 90° right angle.

Holerith's hedging attachment has four circular rotating blades guided by a set of electronic sensors on the outside of the lateral blades to trim two rows in a single pass—the straddled row as well as the top and near side of each adjacent row. The sensors ensure that the blades work close to the vines, but at a proper distance to protect the clusters and trellis from damage.

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The Braud harvester utilizes conveyors of flexible rubber baskets to catch falling grapes and convey them to holding tanks. The design requires a fairly narrow throat, making harvesting of old crookedly-planted rows very difficult. Whereas the most common design employs a parallel series of overlapping, spring-loaded plates that intermesh around vines as the harvester moves, and which are sloped outwards to direct falling berries to the conveyor baskets, the Braud omits the intermediate step.

As a result, harvesting low-trained vines, to within even six inches above ground, is possible. The baskets of Braud's parallel conveyors come together under the vines and are flexible enough to bend around vine trunks. As the harvester moves along, little wear and tear is inflicted on the rubber baskets because there is no actual friction—the speed of the catch-basket conveyors is automatically synchronized to ground speed. Very few grapes are left behind and more effective retention of juice allows late-harvest and botrytised grape picking. The machine can harvest vertical wire trellis systems, but cannot handle T-bar trellis systems.

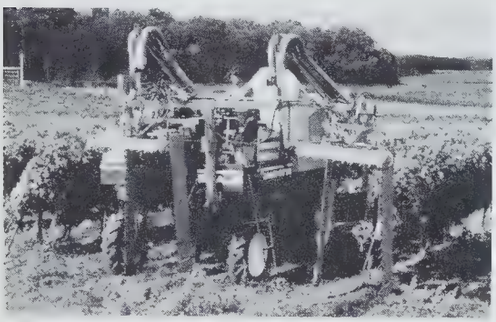
Each conveyor has two blowers to help remove leaves and branches from the baskets. One is positioned at the fruit-receiving level and another on top where the baskets empty their fruit. The air blowers are adjustable with a volume range of 0—150 bar; 70—100 bar is the recommended operating range. A control to adjust the speed of the conveyors is available as an option.

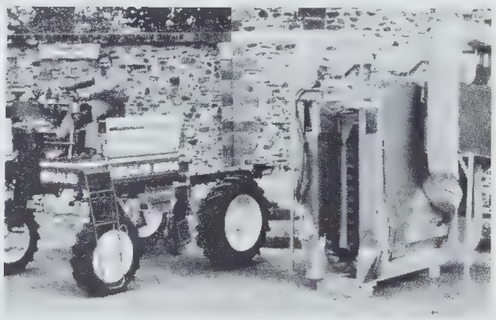
The holding tanks on each side of the machine, with a total capacity of just over two tons, give the operator the option of harvesting a vineyard without a tote buggy. In vineyards where the rows are short enough to permit convenient locations for dumping grapes into transport vehicles—or, alternatively, into the winery's receiving equipment—the self-contained aspect may be useful. At Prince Michel Vineyards, where rows have 100—300 vines, the holding tanks were emptied into a covered stainless-steel gondola at the end of each row.

For vineyards with long rows, cropping greater than the two-ton capacity of the holding tanks, a conveyor/tote wagon system is available for the Braud machine. Similarly, for large operations where tons/hour is a primary concern, the Braud model 1214 with a double set of shakers would be recommended over the multi-purpose model 2714.

The Braud machines have good maneuverability as the model 1214 has 4-wheel drive/4-wheel steering. The turning radius requires 15 feet and neither rough, hilly terrain nor deep mud caused significant problems in the Canadian vineyards.

Fiberglass feeler rods at the base of the harvesting head trigger a yellow light on the control panel, warning the driver to raise the machine if it is being operated too low to the ground. Visibility from the operator's chair is very good—especially important in a harvester with such a narrow throat.





(l to r) Hedging unit, baskets to catch fruit, drive unit with detached harvester unit.

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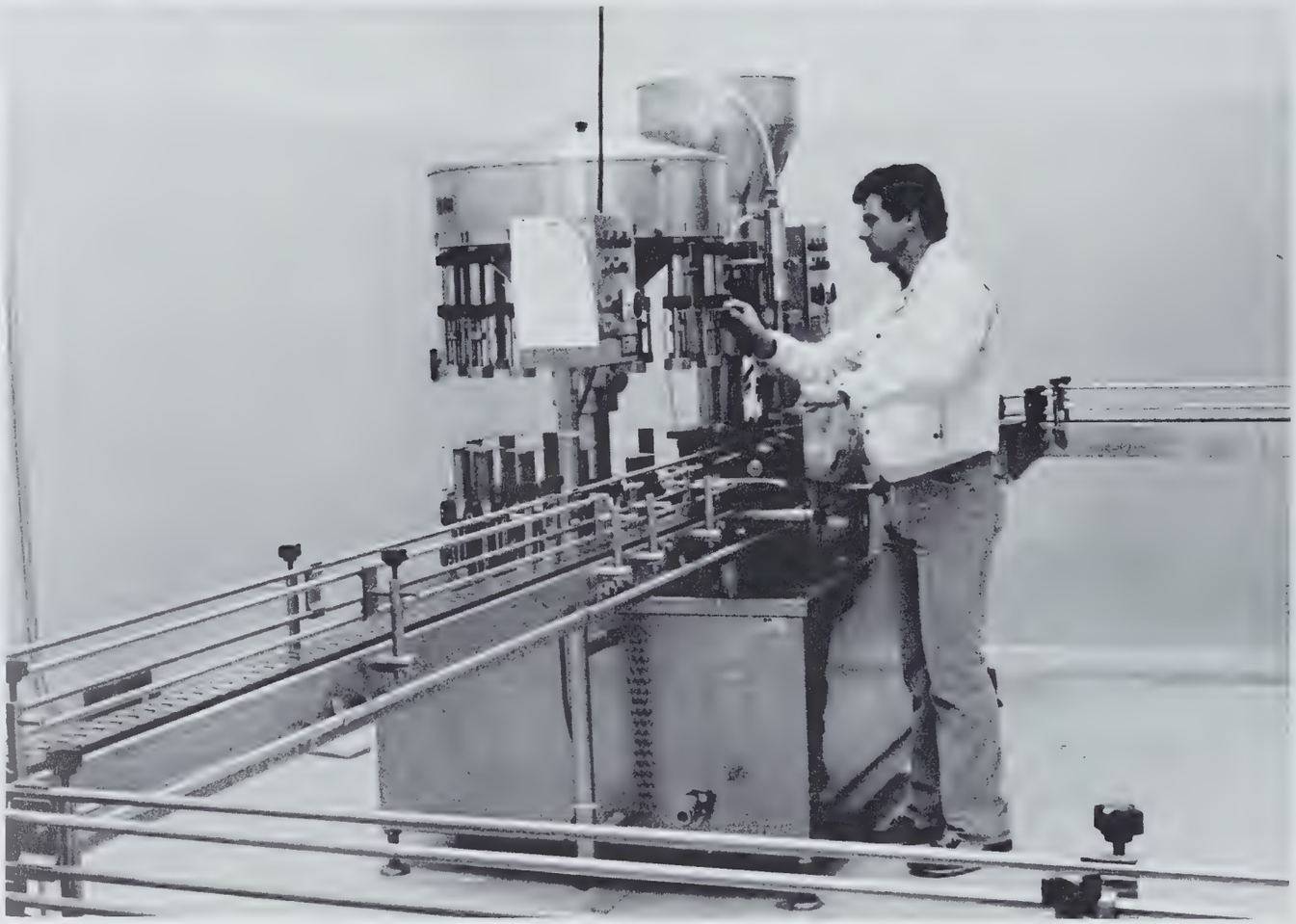

New installation of a GAI monoblock 16-spout gravity filler and vacuum corker is inspected by Greg Bruni, winemaker, Arciero Winery, Paso Robles, CA.

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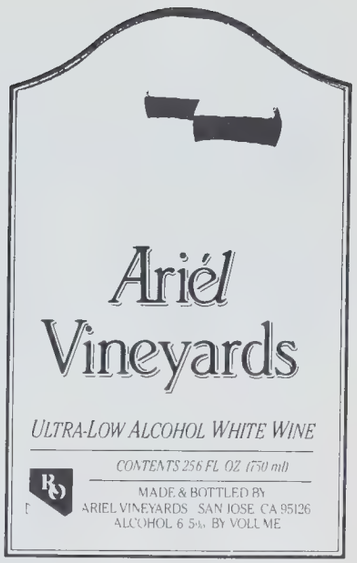
J. Lohr Implements Reverse Osmosis

Joe Tarantino



Barry Gnekow, J. Lohr winemaker, is using a Millipore Corp. reverse osmosis filter to perfect a process that separates water, alcohol, acetaldehyde and other minute molecules out of wine. The result is a concentration of desirable flavor components and the ability to adjust alcohol and sugar. Gnekow has created a non-alcohol (0.5%) beverage and a low alcohol (6.5%) wine under the Ariel label as well as a Chardonnay under the J. Lohr label at the San Jose, CA, winery.

What it all adds up to is the ability to manipulate grapes and wine beyond known bounds of conventional enology. Nonetheless, Ariel products and RO have encountered plenty of resistance, mostly from an industry that doesn't understand the technology, and from a government faced with the task of re-defining wine.

"No one could imagine," laughs Gnekow, "at the time they wrote the laws, that someone would come along and say, 'I'm going to separate out all the molecules in wine below 200 molecular weight.' It's possible to do that now. It's taking slices out of an orange."

Jerry Lohr, winery owner, Gnekow, and brothers Bill and Larry Legion formed Ariel Vineyards specifically to develop commercial applications for reverse osmosis within the grape and beverage industry. Officially in business since August 1985, the real work and research started about two years ago, with assistance from Massachusetts-based Millipore Corp. An inquiry from the Hyatt Corp. about the availability of non- and low-alcohol wine products was the first major order for the new company.

The partners rented a $50,000 prototype reverse osmosis unit which came to J. Lohr in April, 1985, from Millipore Corp. "The idea," says Gnekow, "was to use this as an experimental unit so we could learn our specific needs. Together with Peter Meyer of Millipore, we examined many different ways to operate the system and two different membranes. When we had the important data, we ordered a larger system."

Gnekow created a 3% alcohol wine for the Hyatt hotel chain. Out of that project came Ariel 'Free' and 'ultra-low alcohol' wine for the general public. They are blends of purified carbonated water, Johannisberg Riesling, Chenin Blanc, Gewurztraminer and Muscat Canelli, retailing for approximately $3.00 and $5.00 respectively.

"In a normal filter you flow perpendicularly," says Gnekow. "This technology is called tangential flow. Here, there is a constant sweeping motion of wine parallel to the filter to prevent plugging by the accumulated debris. Thus, only a portion of the fluid fed to the filter is passed through the membrane. The unfiltered portion creates the tangential flow, and it is returned again to the feed tank. The difference between reverse osmosis, ultra-filtration and micro-filtration is a different pore-size filter."

Reverse osmosis ultra-filters wine to remove alcohol, water, and molecules of acetic acid, ethyl acetate and acetaldehyde, while leaving larger, more desirable molecules intact. Each pass through the cycle yields a slight reduction in alcohol, water and VA components, all of which go to a separate holding tank. Contents of the separate tank, called permeate, are sold to a distiller.

Gnekow first concentrates the wine by simply removing filtrate. Once down to a certain level, Gnekow will add RO water (purified water from an outside source), to top his tank and turn the unit back on. If he starts with 10,000 gallons of 12% alcohol wine, three 'volume exchanges', and 30,000 gallons of RO water are needed to create 10,000 gallons of non-alcohol wine.

This process differs from that used by those who make wine without alcohol in that they must add back the same water as they are extracting, thus triggering a "double distillation," says Gnekow. "I add water as I filter. The ideal would be to have two machines, one to filter and one to add water."

A $125,000 custom-built Millipore RO unit, with a 16,000-case/month capacity (four times larger than the prototype), is now in place at J. Lohr. The most important modification, according to Gnekow, is the heat exchange mechanism. "What really makes the process work, compared to other processes, is that we don't use heat," he says. "The alcohol is separated out by mechanical means. All other methods of removing alcohol are a modification of distillation. I'm processing the wine at 45–55°F, so I'm not changing the basic nature of the wine in any way.

Gnekow purchased custom-made fittings and relief valves to handle the unusually high pressure (600 psi), necessary to cycle/filter the wine. Gnekow also devised an electrical system to protect against unwanted power surges. "We got the right electrical connections and control mechanisms such that, if there is a power surge, it'll turn off, then go back on, instead of staying off, then having the back pressure come back against the membranes."

Widespread use of reverse osmosis, which is already employed in the beer, pharmaceutical and dairy industries, will mean a broad-based increase in wine quality, predicts Gnekow, especially among major wineries. "They'll have to adopt this technology in order to compete."

Among premium varietals, RO will have the biggest impact on Cabernet Sauvignon and Chardonnay production according to Gnekow. A 10% reduction is about right for concentrating table wines. But, for distressed wines, there are no holds

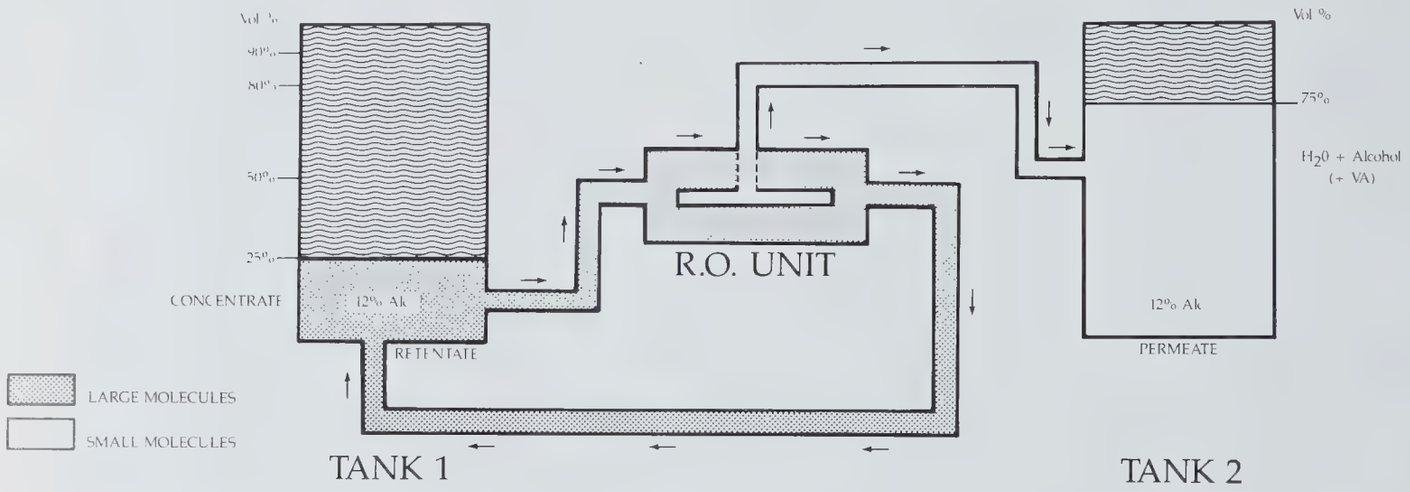
barred. Even wines that have turned to vinegar could be repaired through RO cycling if the process were legalized for that application. Hence, a $.50/gallon wine could be upgraded to a $6.00 or $8.00/gallon quality. "But if you're a bad winemaker," he cautions, "and you get this technology, you'll only become a better bad winemaker. You've got to understand the implications of what you're doing."

A 10% RO reduction of the alcohol and water was performed on a 1984 J. Lohr 'Monterey County' Chardonnay and a 7% reduction on a 1985 'Napa' Cabernet Sauvignon. Tasting the bottled product, the Chardonnay displayed mature-like fruit characteristics, full, yet restrained, with richness and good acidity.

"We assumed that sugar was only sweetness in a wine," says Gnekow. "In fact, it is a major component in your perception of body and size of a wine and it is a major factor in revealing the intensity and varietal characteristics of the grape. Flavors in a wine that we were associating with region and grapes, a lot of times were variations in alcohol, sugar or in other basic components."

Gnekow may label his lot of RO Chardonnay as a J. Lohr 'reserve' later this year if he deems it a superior wine, or it may be marketed along with the rest of the 1984 release with no special designation.

The 1985 Cabernet barrel sample was inky-black and too tannic to bear. "You get a greater concentration of tannins with reds," notes Gnekow. "It varies with the wine you begin with. A Napa Cabernet is a heavily tannic wine. I will barrel-age it



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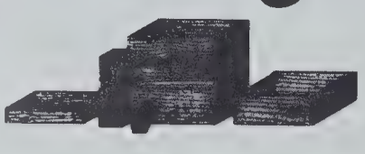

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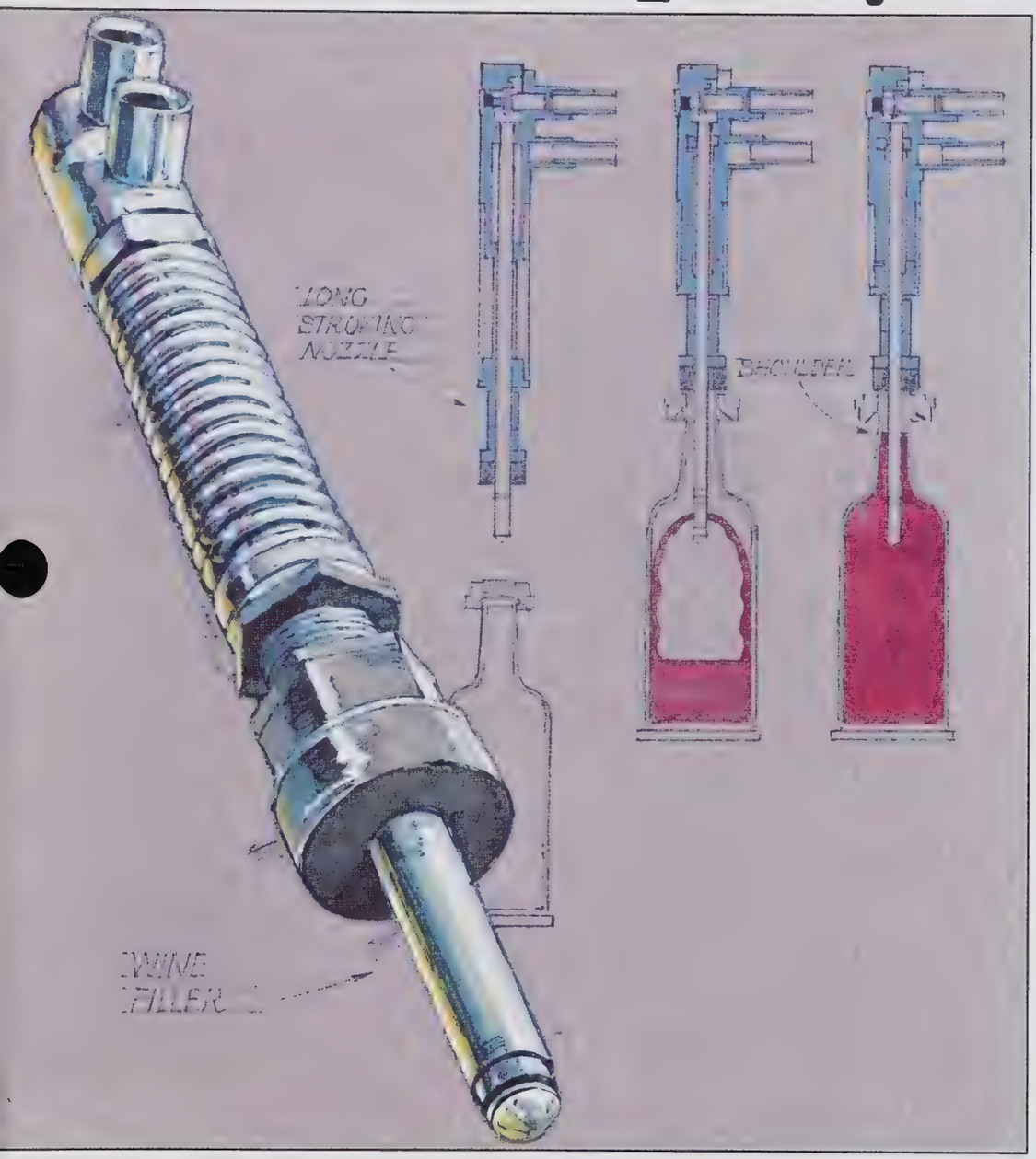

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longer than I would had I not concentrated it."

For the moment, the partnership is putting all their energy behind Ariel products because they think the market is enormous. "The market for non-alcoholic products is maybe ten times the market for alcoholic products," says Larry Legion. "Studies show that most of the wine consumed in the United States is consumed by 8–10% of the population. Only 30–35% drink as frequently as once a month. The bulk of the adult population is non-alcoholic."

Among the advantages of a wine/reverse osmosis combination, according to Gnekow, is that RO allows for a high acid, low pH beverage which can be perfectly balanced by sugar and CO_2. "The beverages people like most have a combination of acid, alcohol, CO_2, pH and sugar in some ideal format.

"The real advantage to making a beverage out of wine is that it has a low pH, as opposed to beer or bottled water, which have high pH, and it has acid. So you've got two things going in your favor, and the sugar (5% r.s. in Ariel 'Free' and 3% r.s. in Ariel Vineyard 'ultra-low alcohol'), and CO_2 can be adjusted to whatever is most desirable (see chart).

"In terms of structure, fruit juices contain sorbate or benzoate. The real advantage wine has is, again, low pH and acid. Fruit juices have acid, but soft drinks and bottled water don't have acid. I have an advantage over soft drinks, beer, and bottled water, and with less carbonation than a cooler."

Ariel's success, or lack thereof, will undoubtedly attract the attention of major wineries worldwide eager to see if Ariel can pass the scrutiny of government regulators and consumers.

The non-alcohol 'Free' is considered a food and its process and distribution are controlled by the Food and Drug Adminstration. Ariel Vineyards is governed by the Bureau of Alcohol, Tobacco and Firearms. Both products, including the low-alcohol wine, must comply with the ingredient labeling code. Both wines are made from a single vintage, but they cannot be denoted as such.

Ariel must retain a winery license and a federal government distillers permit, because of the permeate by-product. "Ultimately, what you get is a lot of ambiguity," says Legion. "The biggest single bill we've had so far is legal fees. We're supporting three separate law firms."

By far the biggest hurdle to public acceptance of low- and non-alcohol products is packaging. But that, adds Legion, may be Ariel's greatest strength. "The most valuable lead we have is not the technology, where we have six months, but in marketing. As long as we keep it in the wine bottle, people tend to relate to it as wine. I can completely change the reaction people have just by changing the setting. It is not a substitute for wine. That is the hardest thing to get across to people when they first approach it. Put us in any situation where people want the alcohol and we won't be successful."

Ariel is evaluating a wide range of formats, except cans, because of potential oxidation problems. Likely modes include plastic containers and 187mL single-serving sizes. The idea, says Legion is to delineate Ariel products from coolers. They have designed a bottling machine that will simultaneously fill 24 bottles in a variety of screwcap bottle sizes.

Ironically, a potential roadblock to the success of 'Free' is its very virtue. "Here's a product that can legally be sold to kids," says Legion. "We are 99.5% alcohol-free. It's physically safe. But there are emotionally charged factors involved. We're not encouraging kids to carry a bottle to school. We are clearly saying, in the manner of distribution and advertising, that it is an adult drink. In some instances it is being handled like an alcoholic product, and only sold to those over drinking age."

Another potential problem is the listed use of sulphur dioxide. Skeptics of RO technology maintain that, without alcohol, Ariel products will need lots of the controversial preservative for shelf-life. Gnekow adamantly rejects this claim as unfounded, "I use 50–60 ppm, about half the amount used in standard wine. We have thousands of cases, bottled in late 1985, at zero, 3% and 6% alcohol. None of it has refermented. The wine should have a shelf life about equal to Chenin Blanc or Riesling, say, 1.5–2 years."

If Ariel doesn't change the definition of wine, it certainly will rework its distribution system. "Much to my surprise," says Legion, "Ariel has been equally accepted in gourmet shops, Circle-K and 7-11 convenience stores."

As a result, Ariel products may end up in the hands of food, candy and beer distributors, partially because of the various state laws governing the movement of non-alcohol products and partly because of the need to dissociate Ariel, especially 'Free', with high alcohol beverages.

If Ariel rises above the challenges, the wine business may never be the same. "I can imagine someone flying to the Hospice de Beaune auction in the year 2000," says Gnekow, "and hearing that Count Such-and-Such at Estate So-and-So decided this year, because of the heavier rains, he's only going to reverse-osmosis down to 7%. Everybody will say, 'Seven percent! seven percent!' And that means prices rise. It's that type of thing. Winemakers are going to have to make the decision of what level to concentrate. All of a sudden, that could become a bigger decision than when to pick."

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Benefits of Leaf Removal, Part II

Mike Marcley

Craig Rous, research enologist at Robert Mondavi's Woodbridge Winery in Lodi, CA, began leaf removal trials on Sauvignon blanc in 1984. The vines are on a 'T' trellis (fruiting wire at 42" with a 24"-wide foliage 'T' at 12–14" above this), spur-pruned and trellised to cordons. Vine rows run east to west (prevailing winds are from the west) and hedging is usually only done on the north side of the rows. Canopies on the south side droop down over the foliage wire.

"One of our growers had been using leaf removal on his Sauvignon blanc since it came into production in 1983," says Rous, "so we continued the trials there in 1984 and included two other properties in 1985. One of these vineyards had been planted in 1974, the other in 1979, making them older, established vines."

He added that trellises in the treated areas of the older vineyards had been converted to be the same as the trellis in the younger vineyard. According to Rous, the grower had noticed better fruit quality (freedom from rot) and earlier ripening in his leaf removal trials in 1983.

"Fruit from leaf removal vines was picked about one week earlier with higher acidity than fruit from other vines," reported Rous. "Since promoting earlier ripening to achieve higher acid levels is a major goal here in Lodi, we were enthusiastic about expanding the leaf removal trials.

"In 1985 we had three hedging treatments, each with a leaf removal and non-leaf removal section in each vineyard. There were 15 vines in each treatment. Minimum hedging was essentially skirting the canopies at 12–18 inches above ground on both sides. Moderate hedging was to the foliage wire only on the north side plus skirting. Severe hedging was to the foliage wires on both sides plus skirting.

"Leaf removal consisted of removing two leaves from above and two from below clusters on each shoot about two weeks after set. It's possible that these older leaves (the ones around clusters) act as carbohydrate sinks so their removal would result in higher berry sugars," he postulated.

1985 results confirmed the 1984 observations of earlier ripening but Rous cautioned that at least three more years of trials would be needed before the effect of leaf removal on ripening could be firmly established.

Tim Hoffman, manager of Hoffman Vineyards, Acampo, CA, has been cooperating with Robert Mondavi Winery, Woodbridge, in leaf removal trials on Sauvignon blanc. He reports that the major benefit of leaf removal is cleaner fruit (having less rot) resulting from exposed clusters and better spray efficiency. He sprays twice with Rovral (1-lb/acre), once at mid-bloom (late April/early May) and once before cluster closure (early June).

"You never know whether it will be a year with rot or not," says Hoffman. "It's best to spray; leaf removal makes that second spray more effective." He emphasized the need for good timing of leaf removal and cautioned against using it before the first spray around bloom, because, in his experience, it resulted in growth of lateral shoots. "Now we do it after set (late May). Then, 3–4 weeks later, we hedge the north sides of the rows just under the foliage wire and skirt the south sides below the cordon wire." His vines are on their own roots (planted in 1981) with 7x12 spacing.

Dan Bosch, vineyard consultant with Crop Care Associates Inc., explains that he advises growers to start leaf removal before cluster closure and adds that he has seen bunch rot on green fruit early in the growing season.

"I go into all our vineyards once a week and I've consistently seen rot way before veraison," says Bosch. "Berries either rot off at the junction of the pedicel, or they get pushed off and fall into the center of the cluster as it closes up. Then rot begins if there is poor circulation and high humidity.

"I've noticed several things that can add to the cost of leaf removal. Many workers tend to remove too much foliage and may even remove leaves from weak vines that already have open canopies. They are also slowed down when vines are too low (fruiting wire below 40"), especially when they are very vigorous and the canopies get in the way." Despite these minor drawbacks, he is convinced of the benefits of leaf removal. "If you only had a certain amount of money for rot control, I'd advise spending it on leaf removal."

Joe Gonzales, foreman for Walsh Vineyards Management, Inc., has been using leaf removal on Chardonnay (126 acres) at their River Ranch on Eastside Road in Healdsburg, CA, since 1984. "Vines are cane-pruned to a three-wire trellis on AxR 1 to six-foot stakes spaced 8x12," says Gonzales. "The fruiting wire is 40" above ground and there is a 24-inch 'T' at about 14" above this.

"Our rows run east–west and the winds come from the southwest, blowing canopies over to the north side. We only use leaf removal (3–4 leaves around each cluster) on the north side because the other side gets plenty of exposure."

They began leaf removal in mid-June 1984 on an experimental

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basis and found that removing too many leaves (6–7) even at this early stage in the fruit growth cycle caused sunburn. "In 1985, our crew of 14 men started leaf removal on June 17 and finished the 126 acres on June 24 (just under 1.5 acres/man/day). That comes to about $40/acre.

"Leaf removal costs are higher for Pinot noir at our Woods Ranch in Fulton. These vines are also on AxR 1 spaced 8x12, but are on a two-wire vertical trellis with either six-foot or seven-foot stakes. This variety pushes out a lot of suckers, even after we clean up the heads, so canopies are thicker than Chardonnay. Also, with foliage on both sides of the wire, we need men on both sides of the row to pull leaves. Our 1985 cost for leaf removal at this ranch was $85/acre."

Gonzales commented that when leaf removal crews try to go too fast, they tend to get heavy-handed and may bruise fruit as they pull leaves out of canopies. This fruit may later crack and start bunch rot. "Close crew supervision can prevent this," emphasized Gonzales.

Berry set is in late May, clusters are closing by the end of June and canopies are on the ground by mid-July when Gonzales begins skirting. The vines received irrigation approximately June 15 in 1985 before they were picked at 18° Brix in early September. A second irrigation was done approximately July 17 in sandy soil blocks.

"We had a week of cool, damp weather after irrigating in 1985 and had to hedge the vines twice in August to dry the fruit out before harvest," reported Gonzales. "Usually, leaf removal and skirting saves from 25–50% of the fruit that would otherwise be lost to rot."

Duff Bevill, of Bevill Vineyard Management, Healdsburg, CA, began leaf removal on both cane- and spur-pruned Sauvignon blanc in 1982. "About a third of our 15 acres of Sauvignon blanc," reports Bevill, "is on bilateral cordons at 42" with a 24-inch cross arm at 56." Because our vines are on AxR 1 in Yolo loam, they have big droopy canopies with poor light and air circulation so we use both leaf removal and cane cutting (skirting) to control rot.

"Leaf removal on one acre of vines in our situation takes one man about two days. We take off any leaves touching the clusters and about 5–6 leaves above each cluster on shoots from both sides of the row for a cost of about $125/acre. In 1983 we weren't able to finish leafing Sauvignon blanc and lost 50% of the crop to rot in the two-acre block.

"These were cane-pruned vines. Leaf removal saved about 30% of the crop because we picked 80–90% of the fruit from the other cane-pruned vines that had been leafed. I'd use leaf removal on Sauvignon blanc even if it cost $300/acre. In 1983 we saved about two tons or $1,600/acre for an outlay of $125/acre. I'd say that's pretty good economics." Bevill is so impressed with the benefits of leaf removal that he hopes to eliminate bunch rot sprays and rely only on cane-cutting (skirting) and leaf removal for rot control in 1986.

Phil Freese, grower relations representative for Robert Mondavi Winery, Oakville, CA, has been using techniques like shoot removal to open up canopies and assist with rot control in large-clustered varieties like Chenin blanc and Semillon for about 4–5 years. "I began using leaf removal on Sauvignon blanc at our Wooden Valley Vineyard in 1982," he recalled.

"The main problem with our California vineyards is getting chemicals to the area that needs protection (e.g. bunches). We need to open up the canopies to achieve this." Freese is so convinced of the advantages of leaf removal that he has expanded its use in the past three years (1983-1985). He claims to have noticed two major benefits of leaf removal on fruit quality in Mondavi's vineyards. First is freedom from rot. The second is better fruit composition and wine quality.

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He explained that these were only general observations and added that several years of field observations had shown it was possible to alter wine styles of varieties like Sauvignon blanc with leaf removal. Increased cluster exposure resulted in fruit that was more golden and translucent with more desirable flavors (less grassiness).

Freese emphasized the importance of assuring that everyone means the same thing when referring to leaf removal. "It's a dog's dish of all different kinds of things," he warned. He has used it on a range of different trellis systems including three-wire vertical and 'T' with both cane and spur-pruning.

"Just removing leaves around clusters that are under a thick umbrella-like canopy may not achieve much," stated Freese. He proposed the need to have an objective in mind before using any form of canopy manipulation. "Modifying the light regime throughout the canopy and in the fruit zone should be the objective.

"The objective is not to just go in and pull off leaves. It is to increase light penetration and air flow both in the canopy and fruit zone. Shoot removal (cordon suckering) and standard head-suckering of cane-pruned varieties accomplishes these objectives in varieties like Cabernet Sauvignon and Pinot Noir while also reducing the crop to desired levels if so needed.

"I get a little nervous talking about leaf removal or canopy manipulation in general terms. It's becoming too much of a catch phrase. What we need is some show-and-tell or method of evaluating the amount of modification of the light and air movement regimes to see what has happened in a range of different situations."

Rob Brittan, vineyard manager and winemaker at St. Andrews Vineyard and Winery in Napa, CA, has been doing leaf removal since 1982, mainly to reduce bunch rot in 63 acres of Chardonnay. "We've always had a severe *Botrytis* problem because our rows run east to west, but the winds come from north or south," says Brittan. "Also, we're one of the last vineyards in the area to pick so the fruit often gets rained on before harvest.

"Our main objective is to maintain fruit in good condition on the vines until picking (usually the first week in October for still wine). This means it will get rained on at least once (usually in early September) so I have to assure that it dries out so there is a minimum of rot in the following 3–4 weeks until harvest. The vines are 13–14 years old and are a mixture of clones on several different rootstocks. The main rootstock is St. George because it was the most popular one in 1971 and 1972."

Fruit from part of the St. Andrews Vineyard goes to sparkling wine production. Brittan doesn't pull leaves from these vines because the fruit is harvested before fall rains begin.

"I spray with Benlate (1 lb/acre) and Captan (4-lbs/acre) during the first 1% of bloom," says Brittan. "In my experience, if timed correctly, a bloom spray is the only one needed to control bunch rot. The sprays I've tried at pre-close (just before the bunches fill in) haven't improved bunch rot control, so I've discontinued them. I want the spray on there when the flowers open. That's the point, in my opinion, when primary infection occurs."

His cane-pruned vines (58 acres) are predominately on a three-wire vertical trellis with fruiting wires at 42" and 62" and the top (foliage) wire at 82" above the ground. "I would

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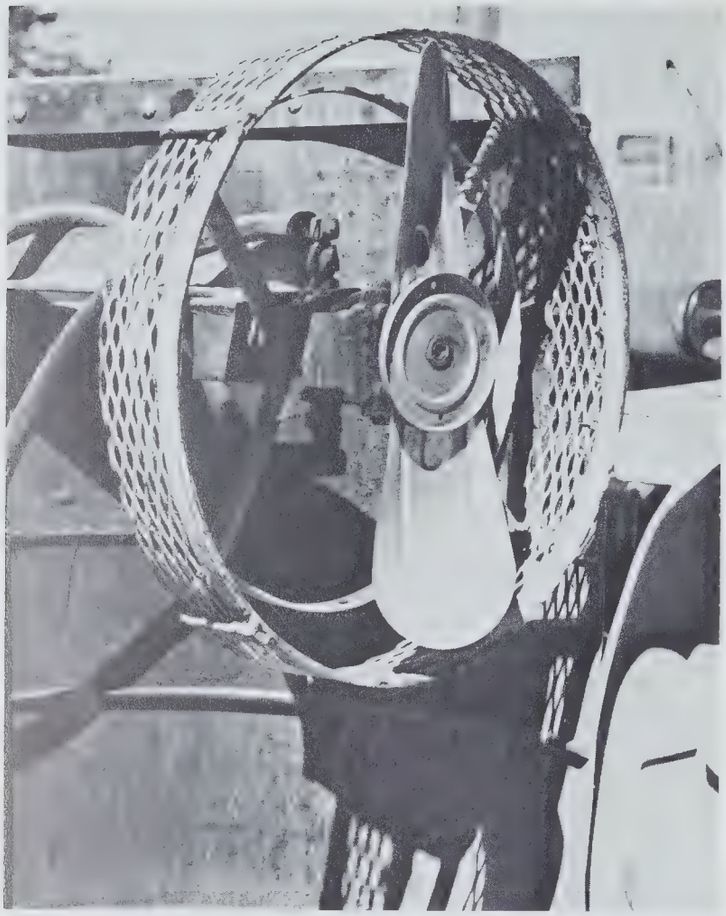

Leaf-plucking machine showing guard behind it to protect driver from flying debris.

like to remove just 2-3 leaves below the cluster stem," says Brittan, "but removing exact amounts of leaves from specific areas of the shoot isn't economic. So our crews just pull leaves from around the clusters. The biggest problem is a tendency to remove too many leaves. This gives too much cluster exposure and the fruit loses the fresh apple-pineapple aroma and takes on more of a sun-cooked character."

He added that the same was true for Sauvignon blanc, claiming that excessive leaf removal with increased cluster exposure assisted in reducing grassy character. Brittan begins leaf removal after set in late June and only removes leaves on the north side of the rows. Then he skirts the canopies at 1–1.5' above ground in mid-late July to further improve air circulation.

"We did not do any leaf removal in 1982 and suffered substantial losses. Since then, we have done leaf removal on more and more acres every year."

Brittan reports that leaf removal only costs about $20/acre and that in a relatively rot-free year like 1984, he reduced loss due to rot by 1% (at 3.5–4 tons/acre and $1,000/ton, saving $35–$40/acre). Even this moderate savings is cost-effective, and in bad rot years it would be substantially greater.

Leaf removal has become a viticultural practice in New Zealand as well. Jane Hunter, viticulturist for Montana Wines Limited, New Zealand, reports that leaf removal by hand was first done in 1983. "The vines were approximately nine years old and had been irrigated for two seasons," Hunter explained. "Problems of excessive vigor with consequent fruit shading and dead leaf matter in the center of the trellis were common. Poor balance between fruit and vegetative growth is a viticulturist's nightmare in New Zealand.

"We have removed leaves from the fruiting zone of Sauvignon

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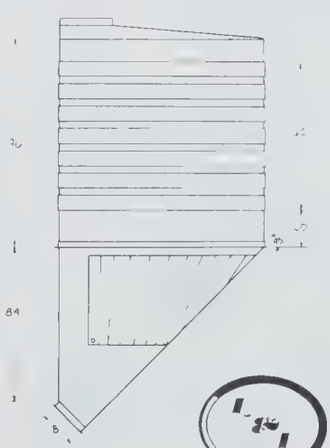

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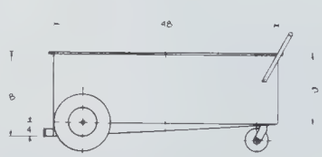

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blanc and Pinotage every year since 1983. Varieties such as Muller Thurgau, Palomino, Rhine Riesling and Cabernet Sauvignon appear to be in reasonable balance; to date, there has been no reason to remove leaves from these varieties.

"We begin leaf removal 2–3 weeks after bunch closure and continue through to harvest, depending on the season and the rate of regrowth. At this stage, we are only measuring fruit quality by the absence of disease, visual wine color, pH, acid and Brix. In all seasons, we have had *Botrytis* in varying degrees.

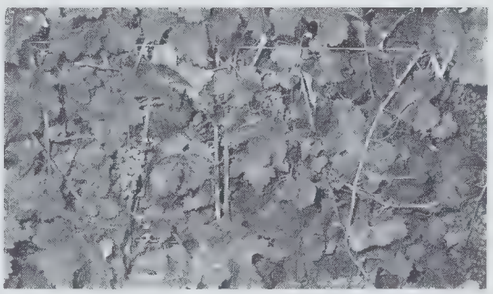
"In 1985 we did trials with a leaf-removal machine measuring 16 inches in diameter with a 3 mph average tractor speed, depending on ground conditions. 1986 is our first opportunity to make measurements of fruit quality. The red wine will be analysed for density of color and all fruit will have a measurement made of percentage *Botrytis* content.

"A number of grapegrowers have now made their own versions of this machine. One grower has made an interesting adaptation–he has extended the static band circumference, resulting in a vacuum effect and greater pull of leaves toward the cutter."

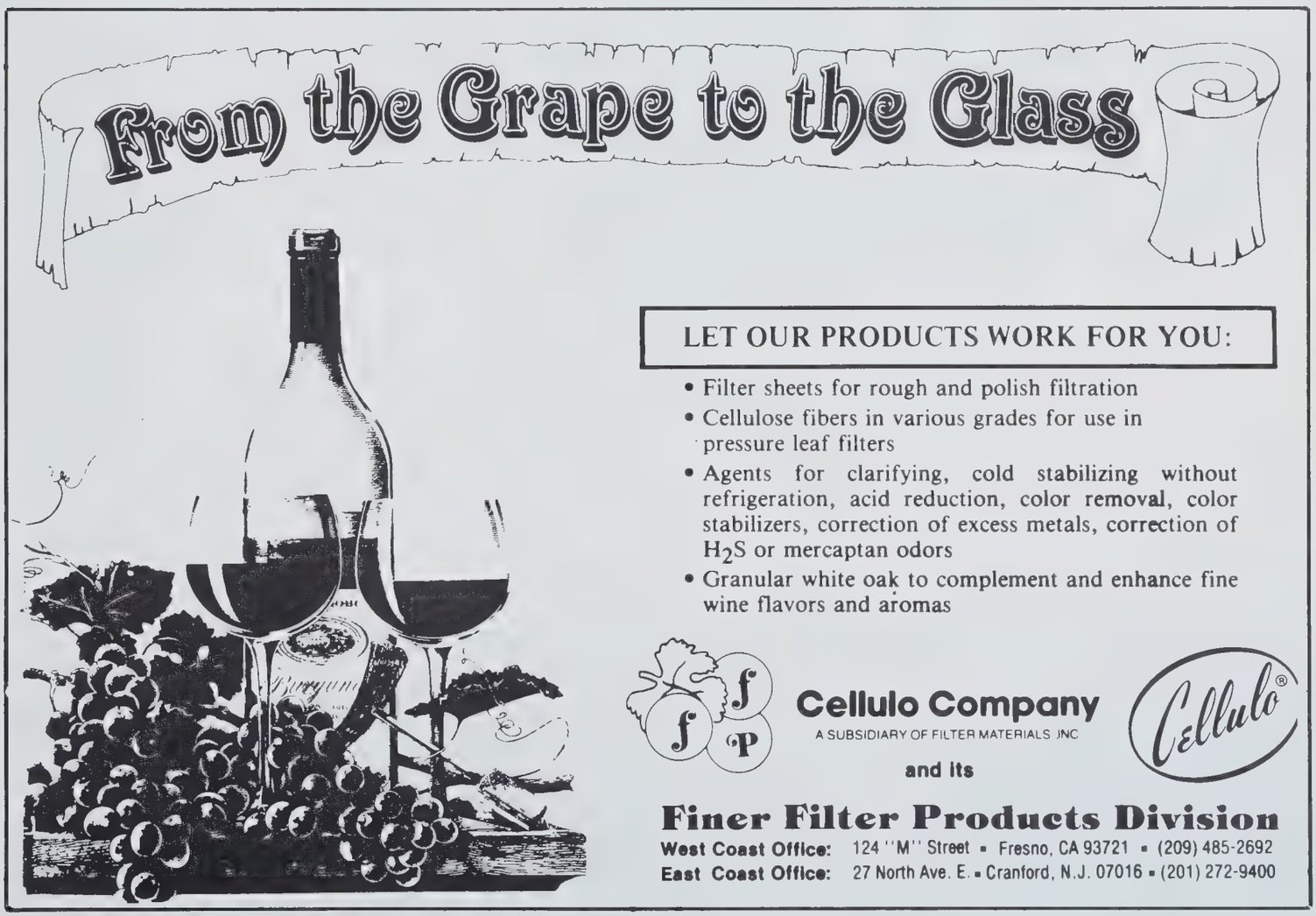
Growing conditions and viticultural practices vary in different regions of the world. Perhaps growers in California and other New-World viticultural regions can adopt the technique of leaf removal to optimize light and air penetration, which also permits most ready access of chemical control agents. They may be able to save money by reducing spraying costs in their task of producing premium-quality grapes.

Leaf-plucking machine in use showing ease of driver operation.

Before.



After–with exposed fruit.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I'll carve your name on barks of trees
With True-Love-Knots, and flourishes,
That shall infuse eternal spring
And everlasting Flourishing,
Drink every letter I'it in stum,*
And make it brisk Champaign become."
R. Butler, Hudibras, 1666

*'Stum' refers to still wine.

In the last *Méthode Champenoise* column (*PW*, Jan/Feb 1986), attention was drawn to some possible merits and deficiencies of a malolactic fermentation of the cuvée or component part of the cuvée. Some méthode champenoise producers appear to be utilizing malolactic fermentations as a means of helping to form the palate structure. Partial bacterial fermentations may be a technique of modifying the sweet-sour perception one experiences occasionally with M.C. produced from low pH/high TA cuvées. In addition, the finish can be broadened and lengthened due to malolactic fermentation.

Lactic acid bacteria can possibly change the flavor profile of M.C. due to the production of flavor compounds such as acetaldehyde, diacetyl, acetic acid, and acetoin as well as a host of volatile esters such as ethyl acetate, n-propanol, 2 butanol, n-hexanol, ethyl lactate, 2-3 butanediol, etc.

The possible sensory benefits which malolactic fermentations may have on méthode champenoise remain unclear. As indicated in the last column, 57% of those méthode champenoise houses that responded declared they 'sterile' filtered their cuvées prior to yeasting and bottling. The filtration procedures involve membranes or 'sterilizing' pads.

The pronounced goal of such an activity is to help effect biological stability by reducing the titer of bacteria and to 'clean up' the cuvée. Lactic acid bacteria are microaerophilic and can easily grow under the pressures normally encountered during prise de mousse. Filtration may, however, not only affect biological stability but also potassium bitartrate stability and possibly riddling ease (Parenthoen and Feuillat, 1979).

It is well-known that a méthode champenoise kept for several years will clarify more easily than a younger product. This observation permits one to suppose that the autolysis of yeast is the origin of enzymatic transformations of wine constituents and particularly colloids. Unclear are the effects which proteolytic enzymes produced by lactic acid bacteria may also have on flavor development, autolysis rate and colloids present.

The time of manipulation necessary for bottle clarification of méthode champenoise is extremely varied, ranging from several weeks to several months. An important factor of this clarification is linked to the composition of soluble colloids both on a quantitative and qualitative level (Parenthoen and Feuillat, 1978).

Colloids possess an electrical charge which may be either positive or negative. In a given colloidal system, all particles have like charges and hence tend to repel one another and remain in solution. Binding of particles of the opposite charge forms aggregates which tend to precipitate. This, of course, is a principal reason for adding fining agents (riddling aids) at the time of cuvée bottling.

The colloid state of the wine depends on the characteristic of the grape, and production parameters. It is strongly modified on the one hand by the techniques used in the treatment and preparation of the still wine and on the other hand by the length of the tirage period.

Production techniques such as filtration of cuvées influence not only the possible biological stability, the potassium bitartrate stability, but also the soluble colloidal content. The significance of these changes will be reviewed in this and subsequent installments.

Wine is able to support a supersaturated solution of potassium bitartrate (KHT) because a percentage of the tartrate and potassium ions are thought to be complexed with wine constituents and therefore not precipitated. Metals, sulfates, proteins, gums, polyphenols, etc., can possibly form complexes with free tartaric acid and potassium ions, thus inhibiting the formation and precipitation of KHT (Pilone and Berg, 1965). These complexes formed are believed to be mainly between polyphenols and tartaric acid in red wines and proteins and tartaric acid in whites. Binding of either free tartaric acid or potassium ions can prevent potassium bitartrate (KHT) formation and subsequent precipitation.

Tight pad or membrane filtration has reportedly adversely affected potassium bitartrate stability by rendering a previously stable wine unstable. Presumably such changes are the results of realignments in the complexing factor equilibria demonstrated in figure 1. Although several workers have alluded to their significance (Pilone and Berg, 1965, Balakian and Berg, 1968), no research has fully demonstrated the involvement of colloids in affecting this change.

If soluble colloids such as polysaccharides inhibit crystal development, the probable method of action would be adsorption

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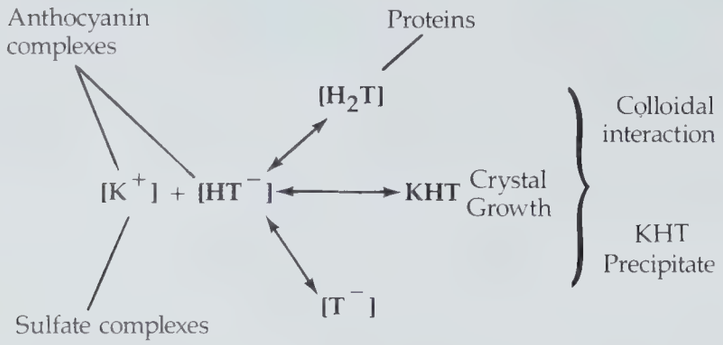
Figure 1
Potassium bitartrate equilibria and the possible interaction of 'complexing factors'.



to the crystal surface. This could effectively prevent further crystal growth and precipitation. Tight filtration could reduce the colloidal content of the cuvée or change the complexing factor interactions to allow subsequent crystal development.

Proteins of white wines can exhibit a holding capacity for tartaric acid, thus inhibiting KHT formation (Pilone and Berg, 1965). White wines may contain a relatively large protein content. As the phenols of cuvées are oxidized (as may occur during filtration) they polymerize, bind to, and coprecipitate with proteins. This oxidation can affect the potassium bitartrate holding capacity.

In a study of white Bordeaux wines, Peynaud et al (1964) found sulfate to be the most important factor in stability besides free potassium or tartrate. This would appear to be due to the complexing ability of sulfate with potassium (Chlebek and Lister, 1966). Almost one-half of the sulfate in white wines and 100% of the sulfate in red wines is hypothesized to complex free potassium as K_2SO_4 or KSO_4 (Bertrand et al, 1978). The difference in the extent of tartrate complexes formed and their 'holding power' to prevent precipitation depends upon the wine in question.

Potassium bitartrate is believed to be produced principally after veraison with the movement of potassium into the fruit. During ripening, the amount of undissociated tartaric acid decreases as the mono and dibasic potassium salts are formed. Simultaneously, tartaric acid is diluted at a rate depending on the variety, meso- and microclimates, cultural practices and the state of maturity, etc.

The practical significance of the above is that winemakers handle juices and wines with large variations in KHT concentrations and possible complexing factors.

In méthode champenoise production, potassium bitartrate stability monitoring and attainment possess some unique considerations. The M.C. producer must be concerned not simply with current cuvée stability but the extrapolated stability following the prise de mousse and ageing *sur lie*.

The solubility of KHT is dependent upon the alcohol content, pH, and the temperature of the wine as well as the interactive effect of various cations, anions and complexing factors. In the production of a Mousseux, approximately 1.1–1.5% (v/v) additional alcohol is produced. This, coupled with ageing and possible dosage addition, can affect the likelihood of potassium bitartrate crystal formation in the bottle.

An additional concern is the relationship between cuvée KHT stabilization methodology and its effect on the wine protein content. The protein content of the finished product is directly related to bubble size and bubble retention (see 'Méthode Champenoise: Juice Treatments', *PW*, Nov/Dec 1985).

Crystal formation may be of little concern when crystals can be easily riddled. Particulate matter of various forms can make riddling more difficult and cause gushing. Particulates (particularly those present in the bottle before filling) occlude very small air bubbles whic act as nuclei on which carbon dioxide comes out of solution. Potassium bitartrate crystals adhering to the walls of the bottle not only can cause gushing but may be difficult to remove.

Potassium bitartrate stability has been traditionally accomplished by chilling. A number of additional methods to obtain potassium bitartrate stability have been attempted. These include filtration (Scott et al, 1981), electrodialysis (Postel et al, 1977), reverse osmosis (Wucherpfennig, 1978), crystal flow (T.M.) (Riese, 1980), and contact seeding. Of these processes, filtration, crystal flow (T.M.), and contact seeding have been the most successful commercially (Ewart, 1984).

Within the méthode champenoise industry in the USA, there appears to be a dependence upon conventional cold stabilization procedures for potassium bitartrate stabilization of the cuvée. In our *PW* survey, only 12% reported the use of KHT seeding as an adjunct or replacement of conventional chill proofing.

In conventional cold stabilization procedures, wines are chilled to a temperature designed to decrease potassium bitartrate (KHT) solubility, which optimally results in precipitation. The most important variables affecting the precipitation of potassium bitartrate during chilling are: 1) the concentration of the reactants, specifically tartaric acid, 2) the availability of focci or nuclei for crystal growth, 3) the solubility of the potassium bitartrate (KHT) formed. Perin (1977) determined the following relationship for determination of the temperature needed for KHT precipitation.

$$\text{Temperature } (^{\circ}C) = (\%\ \text{alcohol})/2 - 1$$

KHT precipitation occurs in two phases. The induction phase is when the level of KHT in solution increases due to chilling. This is followed by the crystallization phase, where crystal

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growth and development occurs. During conventional cold stabilization, precipitation is usually rapid during the first 12 days, then the rate of KHT precipitation diminishes considerably. This reduction is due to a decreased level of KHT saturation in solution.

Temperature fluctuations during cold stabilization can have a significant influence in reducing the rate of KHT precipitation due to the large effect this has on the speed of nuclei formation. Without crystal nuclei formation, crystal growth and subsequent precipitation cannot occur. This fact, coupled with the increased potential for cuvée oxidation and protein precipitation during chill proofing, makes alternate procedures (such as seeding) potentially desirable.

It is instructive for the M.C. producer to know the amount of O_2 that is dissolved in the cuvée during various processing steps—such as cold stabilization. The solubility of O_2 differs with the alcohol content and temperature, among other factors. The lower the temperature, the more oxygen is dissolved. For example, 6mL of O_2/L can be expected to dissolve in wine at 20°C and 8 mg/L at 0°C (Peynaud, 1984). This may become significant during prolonged refrigeration to obtain potassium bitartrate stability.

Oxygen combines with various oxidizable or reducing substance in wine. Oxidation is slow when reducing substances such as phenols are oxidized and therefore protect other wine constituents. Oxidation can be reversible. The determination of a wine's redox potential is a measure which shows the immediate and temporary state of oxidation.

The phenols of a wine are the major substrates for direct reaction between wine and the oxygen in air. Wines low in phenols such as cuvées have a low capacity for oxidation.

More to follow.

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Historical Perspective on Muscat

Charles L. Sullivan

Muscat grapes have been a part of the California viticultural scene since the mission days of the 1850s. American observers of early mission vineyards commented on seeing and tasting a Muscat grape, but its identity and its source are unknown.

In the 1880s California Viticultural Commissioner Charles Wetmore noted that it had spread as a table grape into some American vineyards after the United States seized Alta California from Mexico in 1846. He guessed that it was a seedling of the Muscat de Frontignan (MF) (Muscat Canelli, Muscat Blanc).

The first grape stocks came from the east coast, imported by New England sea captains who made good money importing orchard and vineyard nursery stock in the 1850s. Among the most important vineyard imports were various Muscat cultivars used in New England as table grapes, but in California they were given a try for their winemaking ability.

Among the imports were Muscat of Alexandria (MA), Muscat Hamburg (MH) and MF. In 1861, Agoston Haraszthy imported European varieties, which included 21 Muscat varieties from France, Hungary and Germany. Of these, only MA was distributed.

By the mid-1850s, California nursery catalogues were full of Muscats, many recommended for their winemaking potential. The chief varieties mentioned above were well-established by the late 1850s in the Napa, Sonoma and Santa Clara Valleys, in the Sacramento area and in the Sierra foothills.

During the 1860s wines were being produced from Muscat varieties. Haraszthy showed a sweet Muscat at the Sonoma Fair in 1860, while Charles Kohler was marketing White Muscat on the east coast in 1863. In 1862 viticulutral specialist Clement Detten listed the 10 best European varieties for California winemaking, ranking MF 4th, MA 5th, Grizzly Frontignan 6th and MH 9th.

By 1869 the wholesale price of MF wine was the highest of any price quoted in the northern California market. Isador Landesberger and Arpad Haraszthy produced a very successful sparkling Muscatel and producers of white table wines all over the coastal areas had discovered that a touch of Muscat added to a fairly ordinary white, such as Burger, could make a pleasant demi-sec white that tasted somewhat like a good White Riesling. This became the formula for producing standard California Hock wine until Prohibition years.

Charles Krug, in the 1870s, discovered that Muscats could produce a superior Angelica wine. This was done without fermentation, grape spirits simply being added to the new Muscat must. In the Stockton area George West had begun using MA to make brandy.

The idea of using Muscats to 'Germanize' the flavor of ordinary whites was the offshoot of practices long employed on the Rhine and Mosel in Germany. There, however, Muscat culture was next to impossible because of the northerly climate. The Germans had developed an essence which they added in small amounts to low-flavored wines. They did this by macerating elder flowers in wine spirits, coming up with a flavor similar to the Muscat linalool flavor noticeable in many Rieslings.

In the warmer California climate, winemakers could use the real thing. Jacob Schram's white Schramsberger was a simple Burger wine laced with Muscat. Josiah Stanford's 1873 Riesling was at least ⅓ Muscat.

Straight Muscat wines were produced in two ways, both copies of southern French techniques. The most common was the production of a fortified wine, the fermentation cut off by addition of grape spirits to leave high residual sugar and an alcohol content of about 20%. There were also natural sweet wines produced in the style of the French Muscat Rivesaltes, where the grapes were allowed to hang until extremely ripe and then dried on trays. The resulting must was fermented to about 15% alcohol, leaving much residual sugar.

By the 1880s there was little more heard from the wide variety of Muscat cultivars that had entered the state. Here and there one heard of the Muscat Hamburg, or Black Muscat, but usually as a table grape. The MF and MA only were still in favor.

Charles Wetmore did much in the 1880s to upgrade varieties used to produce California wine. In his many reports he consistently praised MF and insisted that this term be used to

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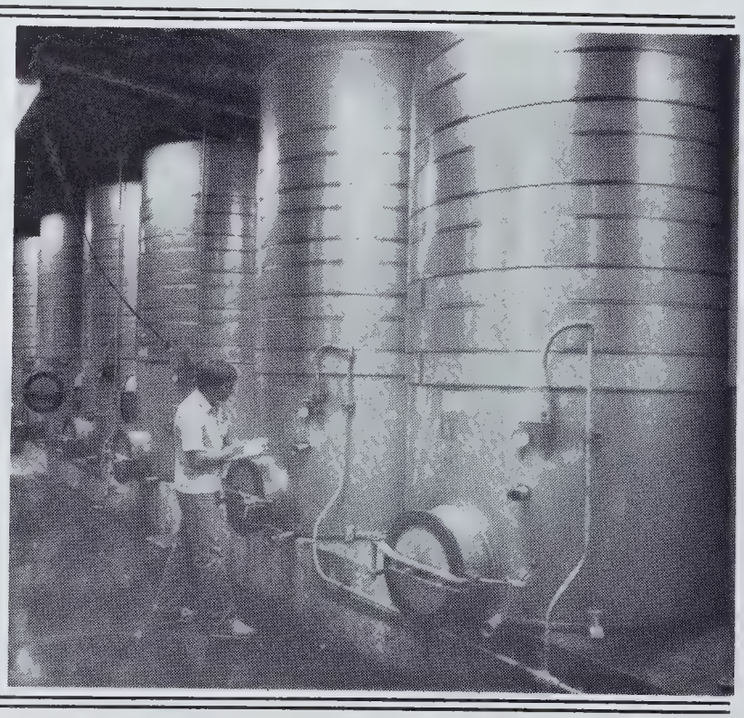

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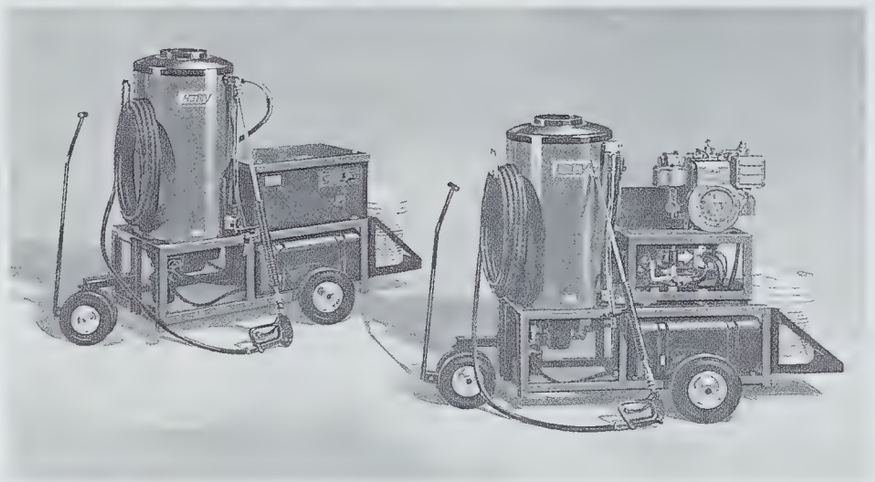

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identify the grape, and it was until recent years. He did not even consider MA in the class of a wine grape and warned growers that what was being grown under the term Moscatel Gordo Blanco was MA. His recommendations and the practical experience of winemakers in these years did much to insure that California's sweet Muscat wines came from the better of the two grape varieties.

Muscadelle de Bordelais, another quality variety, was imported from France in the 1880s. Professor George Husmann recommended it for enhancing the flavor of white table wines. It was planted in the Livermore Valley to help produce that district's California 'Sauterne'.

At the 1888 California State Viticultural Convention, 356 wines were shown, but only six were Muscats. Nevertheless, one could be sure that a very large number of semi-dry white table wines had MF blended in.

Italian Swiss Colony (ISC) put MF to another use in the 1890s, bringing out a Sparkling Muscat in the style of Asti Spumante. The wine, pioneered in Italy in the middle of the century by Carlo Gancia, had become very popular by the 1880s. Pietro Rossi was ISC's winemaster, a graduate of the University of Torino, where the wine had been developed.

At the turn of the century, Husmann described the standard California practice for producing fortified Muscats in his authoritative *American Grape Growing and Wine Making*. The grapes must hang until extremely ripe. They are then crushed and immediately pressed. A gallon of quicklime (unslaked) is added to each 100 gallons of must. Then a quart of grape brandy is added to each gallon of must. These additions are made in an open vat. The liquid is then allowed to stand until clear, which, "as the wine and brandy suppress fermentation, is generally two or three days." The result is then racked into casks and racked again in two months.

The wholesale price of the final product was about the same as for other California sweet wines. In 1889 the top case prices

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were knocked down for wines from St. Helena, Rutherford and San Jose ($6-6.50). 'Lucky' Baldwin got $5.50 for the sweet Muscat from his Santa Anita Ranch. Fresno winemakers received $3.60.

Before Prohibition, about 1–2 million gallons of the 15–18 million gallons of sweet wine produced in California were sweet Muscat. During Prohibition (1920-1933), a revolution in Muscat production took place. Prior to 1920 most MAs were dried, some shipped fresh. In 1921, 3,300 railroad cars of MAs were shipped east for sale to home winemakers. A planting expansion took place, mostly in the Central Valley. By 1925, 19,300 cars, each carrying about 13 tons, took the same route.

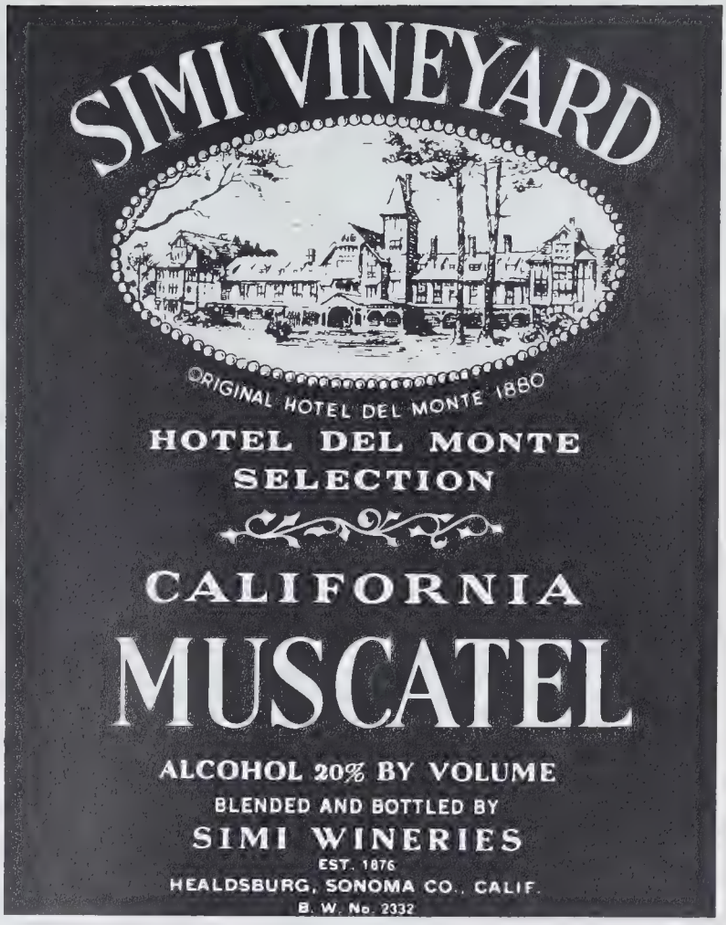
It was not that American home winemakers were making lots of white Muscat wine. The grapes were being used as a blend to lighten and give some depth of flavor to the harsh 'dago red' produced all over the East Coast and parts of the midwest from such grapes as the rough Alicante Bouschet, the favorite of home winemakers for its strength and color.

This Prohibition heritage of well over 50,000 acres of Central Valley MAs had an important effect on post-Repeal California commercial winemaking. What MFs there were in the state were mostly grafted over to MAs during the 1920s.

The best stand of MFs that survived was in the Napa Valley vineyard of George DeLatour of Beaulieu Vineyard. He had been making altar wines for years and in 1910 became convinced of the delicate superiority of MF over MA. In the next three years he grafted over his MAs to MF and continued production of sweet Muscats in Napa and at Wente's in Livermore throughout Prohibition. (Wente's was BV Plant #2 during Prohibition).

After Prohibition, the California wine industry was basically a producer of sweet fortified wines. With the planted acreage of MA, inexpensive Muscatel became an essential part of the industry's production. It served as a cheap source of alcohol for large numbers of Americans suffering through the depression years.

The main part of this production was not low-quality. In fact, Frank Schoonmaker, ever the critic of poor California winemaking efforts, dubbed this post-Repeal Muscat "an honest commoner." Maynard Amerine's chief complaint was that much of it did not have a distinctive enough Muscat flavor, since the 51% varietal rule did not apply to these wines until 1949.



Muscats have lately been confused with 'Muscatel' due to the usage of that term on early labels.

The move to bring back a premium fortified wine from MF began almost immediately after Prohibition was repealed. Schoonmaker encouraged this effort by stating of the MF: "Grown in California and properly cared for, this variety produces what is perhaps this country's best sweet wine."

The most famous of California's Muscat wines in the 1930s was made from MA, almost by accident at first. In 1928 Louis M. Martini crushed out too much MA juice at his Kingsburg plant and stored it in some tanks with cotton floated on top of

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the juice. In the next spring he found that a slow fermentation was taking place and he made this the base for his first experimental Moscato Amabile.

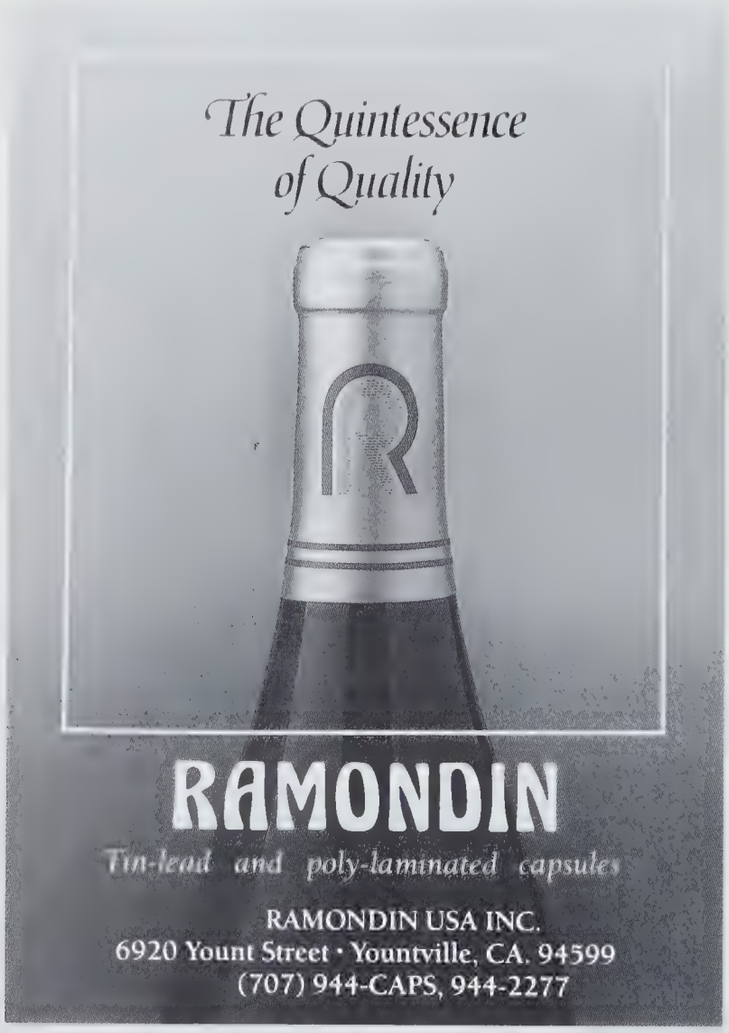
Later, Martini went to Davis for help in developing a systematic process for making this extremely low-alcohol, sweet, slightly sparkling wine. By the late 1930s, a superior commercial product had resulted. Since it usually had less than 6% alcohol, well below the state's minimum, even below the federal 7% base, special permission had to be secured from both the FDA and the BATF to market this specialty item.

After repeal of Prohibition, UC Davis recommendations for wine varietals appeared. They were not officially published until 1944 but were based on data collected by Professors Amerine and Winkler during the 1930s. The top rating for Muscats went to MF for its great flavor and superior acid balance. It was recommended for regions II to V.

They also gave very high marks to the Orange Muscat, which they termed a 'recent introduction'. Almost all their samples noted the very distinct character of its Muscat aroma and they favored it over the MA for regions IV and V. Malvasia Bianca also received good marks for its Muscat flavor, its yield and its even-ripening characteristics.

A special recommendation was made for MH. It was clear that some excellent dessert wines were being produced on a small scale in regions I and II by Novitiate, in Los Gatos, CA. But it was not recommended for warmer regions because of its low color. The professors enjoyed the natural sweet wines from this variety, "balanced, full, rich and fairly smooth."

In 1939 there were over 60,000 acres of MA in the Central Valley. But much of their product during World War II went to raisin production. After the war a gradual change in the character of the state's and nation's wine tastes took place, as did the taste for Muscat wines.



An analysis of the MA acreage and crush statistics provides us with an evolutionary view of part of the change in American wine tastes. In 1948 Muscats made up over 10% of the total wine crush. But from 1953-57, they averaged 6.8% and from 1958-62 just 5.2%. Between 1961-72, the total MA acreage fell from 21,000 to 12,000 and amounted to less than 2% of the crush by 1972. This 2% figure, sometimes a bit less, has held to the present.

In 1985, 46,000 tons of MA were crushed, amounting to 1.7% of the total crush. These statistics represent a decline in absolute tonnage as well as a general growing total crush. The combination of factors has accelerated the diminishing character of the percentage. For example, the number of MAs crushed in 1985 was about the same as in 1961 but the state's crush in 1985 was almost double the earlier one.

In recent years MF has been more often referred to as Muscat Blanc (MB), after its proper French name, Muscat Blanc à petits grains. In 1972 there were 390 acres. By 1984 there were 1,735 acres—65% in the Central Valley. The remaining 601 acres were fairly evenly distributed through the North and Central Coast districts and the Sierra foothills. In 1982, 269 new acres were planted.

There were also 71 acres of MH, all but three of which were in the Central Valley. There were very small plantings of Orange Muscat and Muscat Ottonel, a variety that ripens earlier than MF, and has been replacing that grape recently in Alsace.

For future note is Symphony, a UC Davis hybrid, a cross of MA and a light-colored Grenache, which produces an excellent white wine. Professor Harold Olmo began work on this cultivar in 1940. He thinks it will produce excellent dry and sweet wines with "a delicate Muscat aroma and flavor" (see accompanying story).

The tiny revolution implied by these quality statistics really began in 1950 when the Christian Brothers in Napa found they had more MF grapes than they needed for their altar wine. At first they made two sweet wines, both light, but one sweeter than the other. In 1958 they discontinued the sweeter wine and in 1960 named the remaining product Chateau La Salle.

An analysis of wineries winning medals at major competitions for their premium Muscats in 1984 shows 24 different producers, ranging from such as Charles Krug and Parducci to smaller producers like Ballard Canyon and Shenandoah. Even Washington State wineries such as Chateau Ste. Michelle and Tucker Cellars have produced Muscat Canelli.

The current vogue in Muscat wines includes both the fortified and the natural sweet, with a definite leaning toward the latter. Robert Pecota's long-term devotion to this style of wine is indicated by his Muscato di Andrea, produced since 1980 and named for his daughter.

Madera's Andrew Quady has built his business in the 1980s

on fortified Muscat wines. His Essensia is made from Orange Muscat, his Elysium from MH. The latter is the base for a new cocktail being consumed in San Francisco: the Love Bug, ⅔ Champagne and ⅓ Elysium.

Potential for MB in the future is perhaps indicated by the average prices paid in the premium wine districts for that grape in 1985. For Mendocino County, the cost/ton was $400; for Lake County, $500; for Sonoma County, $594; for Napa County, $599; and for Monterey County, $291.

The 1985 Napa price was 10% more than that for Sauvignon blanc and 40% more than for Gewurztraminer; in Sonoma, it was 30% higher than for White Riesling. In Fresno County, the price averaged $152/ton in 1985. In Kern County, the average was $101/ton. Prices for Orange Muscat in the Sierra Foothills averaged $700/ton, and in Monterey the average was $604/ton.

Recent developments in the production and consumption of fine table wines in California would have delighted the 19th century pioneers of the industry such as Wetmore and Haraszthy. They would have understood it, perhaps even predicted it. They would also certainly have approved of the developments in recent Muscat wines. But their experience would never have led them to predict it.

Symphony

The hottest new Muscat item in California is a not-so-new UC Davis hybrid, Symphony, a cross between the Muscat Alexandria and a light-colored Grenache. It was developed by Professor Harold Olmo, who began testing the grape in 1940. In 1982 it was patented and distributed to nurseries. Olmo claims that it is one of the best-tested varieties ever produced at UC Davis. It took a long time before release because at first its buds did not survive heat treatment, aimed at insuring that the vines would be virus-free.

One of Symphony's charactertistics is the fact that it can be used to produce good sweet and dry wines. Heretofore, Muscat varieties were noted for their bitterness in the finish of their dry products, which could only be masked by leaving some residual sugar. Symphony has flavor and aroma similar to the classic Muscat Blanc (Muscat Frontignan, Muscat Canelli).

Another advantage to Symphony is its ability to bottle-age without a great decline in its Muscat character. Olmo has stated, "We have samples over 12 years old in the bottle that are very aromatic, unlike most Muscats, which lose their character quickly."

California's first producer of a Symphony wine was Tremont Vineyards, located in Davis and owned by Harold Olmo's son, Paul. In 1982 he made a dry Symphony from grapes he procured from the vineyard at the University's Kearney Field Station near Fresno. His 1984 is a commercial product now on the market, and he thinks his 1985 is the best to date. All these wines are dry; they have to be since Olmo does not have the equipment necessary to produce a natural sweet wine yet.

Pat Paulsen Vineyards produced an off-dry (0.70 g/100mL residual sugar) 1984 Symphony from the 20-acre De Baun Vineyard near Santa Rosa. Steve Gallegher of Manteca has a six-acre block and is one of its foremost boosters. Last year they came in at 0.70 g/100mL TA and 22° Brix.

Along with the advantages of chemistry comes a remarkable tendency for astonishingly high yields. The Kearney plot has been averaging the equivalent of over 15 tons/acre. Paul Olmo thinks that higher yields of good grapes may be possible.

For now there is a 'wait and see' attitude toward Symphony. But if these numbers and taste evaluations hold up in the future, and consumers continue to show an interest in premium Muscat table wines, there can be no doubt about its future success and expansion.

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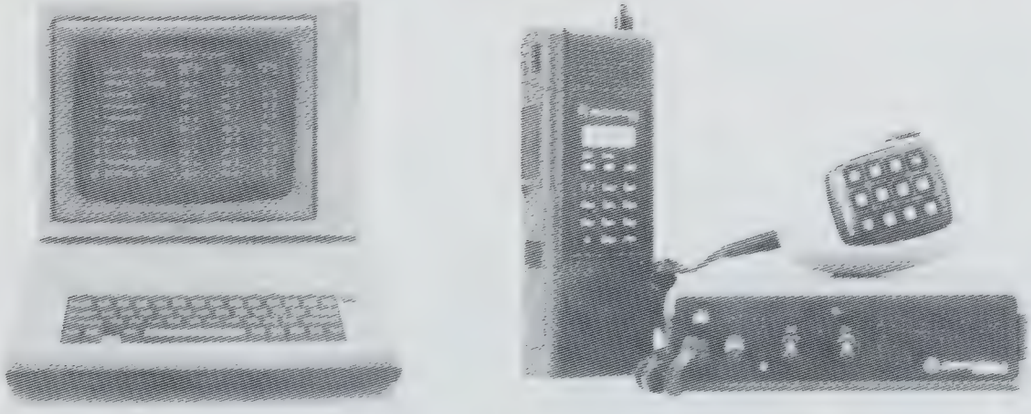

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Muscat

SHENANDOAH VINEYARDS BLACK MUSCAT

PW: Describe your style:

Leon Sobon: Our style is a dessert wine that is sweet, fruity, and low in tannin, with moderate (15–16%) alcohol. By picking ripe fruit (23°+ Brix) and fermenting at 80-85°F, we accentuate the varietal character. We recommend serving this wine with fruit, cheese or light desserts. Estimated cellaring potential of the wine is 5-10 years.

PW: Describe the vineyards:

Our grapes are purchased from Eschen Vineyard in Fiddletown; Dillion Vineyard in the Shenandoah Valley; and Gallegher Vineyard in Manteca. Average yield is 3-7 tons/acre. Eschen and Dillion are both Region III; Gallegher is Region IV. Steve Gallegher grafted over Ruby Cabernet on its own roots to Muscat Hamburg in 1980. The vines, planted in 1972, are spaced 7x12 and cordon-pruned to eight two-bud spurs/vine to yield an average of 8–10 tons/acre. The deep, sandy loam receives four avenue irrigations per year, totaling 24–25 inches of water.

Gallegher describes Muscat Hamburg as having thick skins with no problem holding up under one or two rains. The clusters are loose, offering no bunch-rot problems. Gallegher's typical spray program includes one or two sulfur dustings before his first Bayleton spray, which will be mixed with foliar zinc just before bloom. Another sulfur dusting is done and followed by a mixture of Bayleton and pesticide for leaf-hopper about June 1. One or two more sulfur dustings complete the cycle. Gallegher, who has both Muscat Hamburg and Muscat Canelli, reports that Hamburg is usually picked at the end of September, one month later than Muscat Canelli.

Average annual rainfall in Amador County is 35." There is potential frost damage until May 15. Budbreak occurs about April 15, with berry set about June 15 and veraison about August 1.

Viticultural problems with this varietal include light set, excess vigor, and leaf hoppers.

PW: When are the grapes picked?

Grapes are picked from September 1–25. Color, flavor, sugar, and acid are the deciding factors as to when to pick. All grapes are hand-picked.

PW: How is the wine made?

60ppm SO_2 is added at the crusher. Before inoculation, acid adjustments with tartaric are made to adjust to 0.70 g/100mL TA. Skins are soaked ½–1 day prior to inoculation with active-dry Montrachet yeast at 1% inoculum.

Fermentation peaks at 80-85°F and we press off at 5–6 days at 12°–13°Brix. 190 proof alcohol is added immediately after pressing and is circulated to blend to achieve 16% alcohol. Yield is approximately 190 gal/ton, including about 21 gal/ton of spirits added. Cap management includes 4 pump-overs/day for three days for 15 minutes each time with a centrifugal pump.

The wine is racked off the yeast lees 2-3 days after fortification at 10 g/100mL residual sugar. The yeast lees are filtered and the lees wine added back. Free run and press wine are all kept together. The wine is racked once every two months for a total of three more rackings. SO_2 is added at each racking to maintain 0.8 molecular.

The wine receives a medium DE filtration off the yeast lees and goes to 60-gal neutral barrels which are topped monthly over a 7-month period. We fine the wine with 0.7 lb/1,000 gal gelatin and settle 7–8 days before doing one sterile-pad filtration. The wine has approximately 30ppm free and approximately 120ppm total SO_2 at bottling and is bottle-aged 2 - 3 months prior to release.

Leon Sobon

JEKEL VINEYARD MUSCAT CANELLI

PW: Describe your style:

Rick Jekel: To accentuate the varietal character, we pick at full maturity and ferment cold. The wine is balanced with 0.90 g/100mL natural grape acidity, 2.5 g/100mL residual sugar, and relatively low (10.5%) alcohol. It goes well with any fish/seafood dish or light chicken dish.

Upon release, the wine is intensely fruity, clean, and crisp. At optimum maturity, it is crisp, fresh, and full on the palate. Outstanding characteristics include fresh, clean fruit flavor and typical Muscat aroma. Estimated cellaring potential is 2–5 years.

PW: Describe the vineyards:

We purchase grapes from Arroyo Seco Vineyards in southern Monterey County. Vines were planted in 1972 on 8x10 spacing for 650 vines/acre. Vines are cordon-trained and spur-pruned with 'fruiting canes' to be compatible with machine harvesters. Pruning occurs in January. Ten to twelve 2-bud spurs plus 2 full-length canes/vine are left. Average yield is 4–6 tons/acre.

Rick Jekel

Soils are 1–2 feet of sandy loam over a deep sand and gravel base. Annual rainfall is 9–10." Irrigation includes three applications of two 1–2" throughout the year.

Budbreak occurs mid-March, with berry set in May, and veraison in July. Strong ocean climatic influence from Monterey Bay keeps the climate relatively cool and moist. The vineyards receive three applications of Bayleton.

PW: When are the grapes picked?

This varietal should be picked early to avoid high alcohol and harshness. We generally harvest this varietal in September. Sugar is the determining factor for picking; we look for a range of 20–21.5° Brix. Grapes are mechanically harvested.

PW: How is the wine made?

No SO_2 is added at crush, nor are acid adjustments made. Skin contact is 6 hours at 45°F and achieve a total yield of 180 gal/ton. We use 5% rice hulls as a press aid. 5% pure-strain Steinberg liquid yeast is used to start fermentation, after juice is settled overnight and racked. Fermentation lasts 45–60 days at 35–40°F.

First racking off yeast lees takes place when the desired sugar level is reached, about 2.5 g/100mL residual. We rack one or two more times when applicable. Thirty-five ppm SO_2 is added after fermentation and at the next racking. Our heat-stability test is 160°F for 2 days followed by freezing and thawing. Bentonite is added at 2–4 lbs/1000 gal. This takes place during stabilization after fermentation. Cold stabilization is done by chilling to 25°F combined with seeding with K-bitartrate at 0.5 gm/L.

The wine is filtered as soon as possible after fermentation with medium DE. A 0.45μ membrane is used at bottling. The wine is bottle-aged 2–4 months before release.

QUADY ESSENSIA

PW: Describe your style:

Mike Blaylock/Andrew Quady: We try to capture the subtle orange-apricot varietal character of Orange Muscat so that the finished wine has the tangy-sweet character of fresh oranges and apricots. A slow, cool fermentation tends to accentuate this character. Muscat Canelli is blended into our Orange Muscat because it has a grapefruit character which complements the Orange Muscat.

As a dessert wine, Essensia achieves a balance between sugar, acid, and alcohol. We strive for residual sugar of 13.5 g/100mL, TA of 0.75 g/100mL, and alcohol of 14.5%, which allows it to be enjoyed by itself or with dessert. Essensia complements desserts which contain flavors of almond, orange, or apricot. Dark chocolate also goes well with Essensia.

Upon release, Essensia is a golden-amber wine of delicate orange blossom and apricot aromas with tangy orange-honey flavors. At optimum maturity, it becomes a rich golden color with spicy mandarin orange aromas and flavors reminiscent of teaberry, nutmeg, cinnamon, orange marmalade, and clover honey. Cellaring potential is about 3 years.

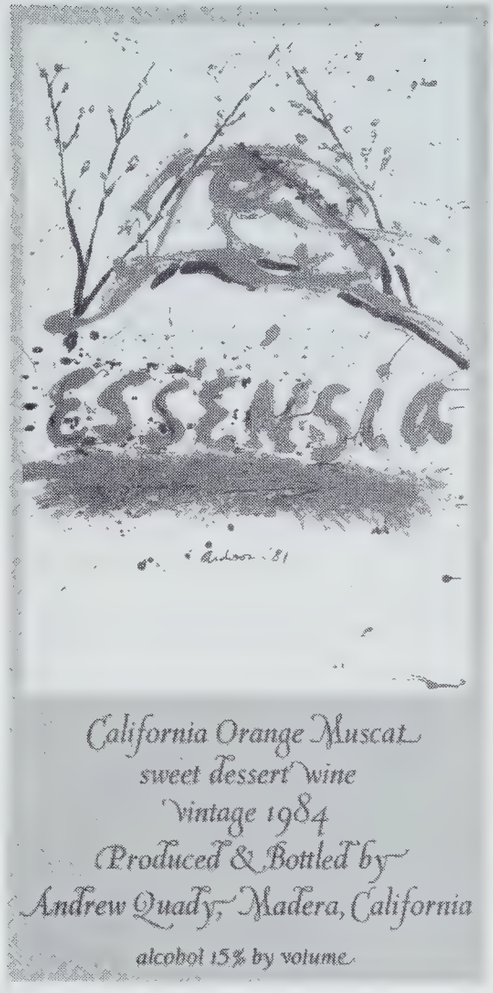
PW: Describe the vineyards:

We purchase grapes from vineyards in the San Joaquin and Sacramento Valleys. Elevation is about 270 feet. Vines are planted 7x11 and are modified head-trained and cane-pruned. This increases the pre-bloom leaf production, which decreases shot berries and encourages better overall berry set. Pruning takes place in mid-winter with 6–12 buds/cane and an optimum of 8–9 buds/cane.

Soil is sandy loam with pH of 7.0 and a depth of one foot. Subsoil is sandy. Annual rainfall is 10.52" with rainfall in growing season of 3." Budbreak occurs in late March, with berry set in early May. Veraison is in early July.

Viticultural problems with this varietal include slow growth with a lack of vigor on sandy soils. Also, bilateral cordon shoots tend to die back overwintering.

Andrew Quady



PW: When are the grapes picked?

Grapes are hand-picked from early August through early September. The taste of the berries ultimately determines when they'll be picked.

PW: How is the wine made?

75–100 ppm of SO_2 is added at crush, along with malic and tartaric to increase TA to 0.75 g/100mL and lower pH to 3.5. Grapes are pre-cooled by being held 2 weeks in cold storage at 45° before crushing. A 2% inoculum of active-dry Montrachet yeast is used in the 2- to 5-day fermentation at 60°F. Pressing occurs when we feel we have attained the desired flavor extraction without the bitterness associated with grapes in the Muscat family.

First racking off the lees occurs approximately one month after pressing. Before 3–4 months of wood ageing, the wine is rough-filtered with a lees filter using coarse DE. Four- to seven-year-old shaved 60-gal French oak cooperage is used for ageing. The final blend, including 15%–20% Muscat Canelli, is made before wine goes into barrels.

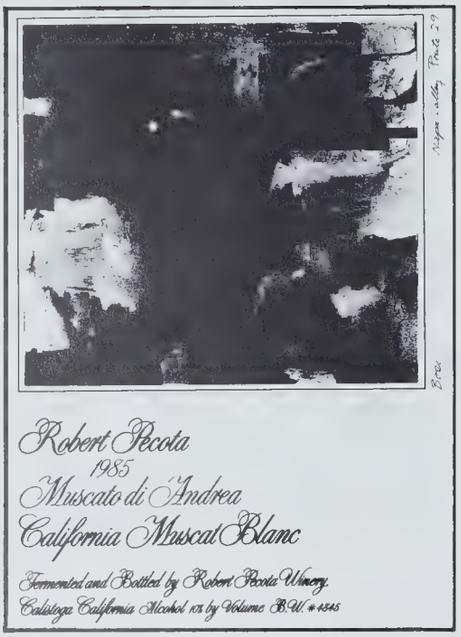
The wine is both cold- and heat-stabilized. After barrel ageing, the wine is brought down to 26°F for one month and seeded with tartrate crystals. Bentonite is added at 2–4 lbs/1,000 gal after cold stabilization. The heat-stability test involves heating the wine at 125°F for 48 hours, then examining it for haze after 24 hours at room temperature. Thirty ppm SO_2 is added to the wine at both cold and heat stabilization.

The wine is filtered prior to bottling with tight pads and tight DE. Free SO_2 at bottling is 25 ppm and total SO_2 is 100 ppm. The wine is bottle-aged one month before release.

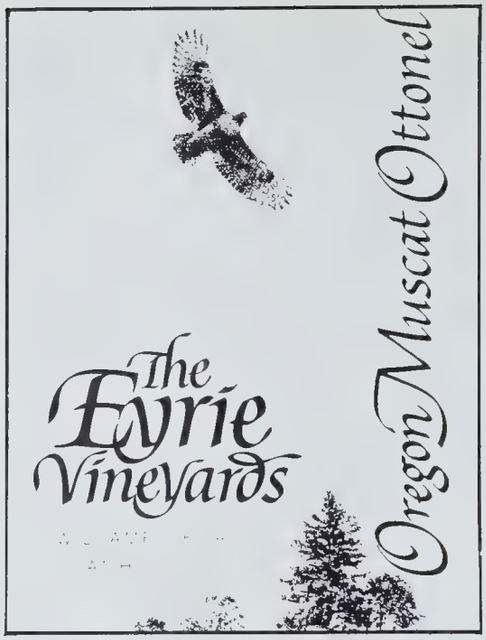
ROBERT PECOTA MUSCATO di ANDREA

PW: Describe the wine:

Robert Pecota: Our style resembles a spatlese or auslese Ger-


Robert Pecota
1985
Muscato di Andrea
California Muscat Blanc
Fermented and Bottled by Robert Pecota Winery
Calistoga California Alcohol 11% by Volume B.W. #1545

Robert Pecota



David Lett

man Riesling. It is recommended with any fruit-based dessert and also goes well with spicy-hot dishes such as Szechwan. Our finished wine is 9x9; that is, 9% alcohol and 9% residual sugar to mask any bitterness. Muscat Canelli (Blanc) is the most delicate of the Muscat family; it is one of the most highly-scented wines made. It also has elements that can make the wine bitter.

We must overcome the consumers' conditioning that Muscat is Muscatel. We need to demonstrate to retailers and restaurateurs that Muscat Blanc and sweet Rieslings have a place as 'dessert' wines which will age well.

We produced 2,000 cases from the 1985 harvest and may peak someday at 3,000 cases annual production, as the market for Muscat is growing, but quite narrow. It is based more on brand identity ('Essensia', 'Muscato di Andrea', 'Muscato di Oro', etc.) than on the grape variety itself.

At bottling, the wine has sheer fruit power and is bottle-aged 30–45 days before release. As the fresh, fruity and sweet wine ages, the raw fruit power dominates. The wine becomes more aromatic with age as the simple sugars polymerize and dry out.

PW: Describe the vineyards:

We buy from one vineyard in the Alexander Valley and added another in Calistoga that was fourth leaf in 1985. The vines are spaced 8x10 and are cordon-pruned on bilateral trellises with 6 spurs to each arm. Shatter is a big problem; we get variable yield, usually about 35 tons from 11 acres in our Alexander Valley vineyard. But in 1985 we only got 22 tons from 11 acres. To minimize the variable production, two kicker canes are left on the three-wire 'T' trellis until set; if the set is good, the kickers are removed or left to compensate for the shortage.

Muscat grapes are very aromatic in the vineyard. If they ripen to 25° Brix, we get 5–10% loss due to bees, birds, and wasps which are attracted to the aroma.

PW: When are the grapes picked?

Grapes are picked at about 25° Brix, or before impending major rains.

PW: How is the wine made?

Muscat grapes are very glutinous and require press cycles with low pressures and long tumbling on long cycles to achieve 145 gal/ton yield. For instance, we might press Sauvignon blanc on a 40-minute program but require 90 minutes for Muscat.

We add 40-50 ppm SO_2 initially after pressing. We rack off the juice lees and add back the juice from the filtered lees and bump the SO_2 to 40-45 ppm free. We added between 2 and 4 lbs/1000 gal of bentonite. 50% of the fermenter is pumped over before inoculating with 3% active-dry Epernay yeast. Epernay is used to start fermentation because it is easier to stop. Fermentation temperature is 50°F.

Our heat stability test takes place over 12 hours at 120°F, then the wine is chilled to freezing and returned to ambient temperature of 70°F for inspection of possible haze. The wine receives a tight pad filtration before bottling. The wine has some dissolved CO_2 at bottling and 30 ppm free and 85-100 ppm total SO_2.

EYRIE MUSCAT OTTONEL

PW: Describe your style:

David Lett: Our Muscat Ottonel is dry, with no residual sugar, and has defined Muscat aroma. We pick in mid- to late September to maintain acid and to de-accentuate the aromatic aggressiveness of the variety. The wine balances low alcohol with moderate acidity.

This wine goes well with curry dishes or spicy Chinese food, and is also good as an aperitif. Estimated cellaring potential is five years. The best characteristic of this varietal is its ability to ferment to dryness and retain true varietal aromas.

PW: Describe the vineyards:

We own 1.5 acres of hillside vineyard (450 feet elevation) with a south exposure planted to Muscat Ottonel. Vines were planted in 1966 on own roots spaced 6x10. We use a vertical curtain training/trellising system, and cane-prune to 12 buds/cane. Average yield is 1–3 tons/acre. The soil is clay loam of basalt origin. Topsoil is nine feet deep, and soil pH is 5.7. The vineyard is fertilized with urea each March.

We have about 2,000 degree days/year, with 40 inches annual rainfall, about 10" during the growing season. The vineyard is not irrigated. Budbreak occurs mid- to late March. Berry set is sporadic, while veraison takes place in August. Poor set is a viticultural problem with this variety.

PW: When are the grapes picked?

Grapes are hand-picked and the sugar/acid balance is the determining factor in deciding when to pick. Optimum balance is 17.5° Brix/6–6.5 g/100L TA.

PW: How is the wine made?

50 ppm SO_2 is added at crush, and stems are used as a press aid. The juice is settled for 24 hours and racked and the juice lees are blended back after filtration. Active-dry Pasteur Champagne yeast at 2% inoculum is used to start the 6-month fermentation.

First racking off the yeast lees occurs at bottling. SO_2 is adjusted between fermentation and bottling to 50–70 ppm total. Malolactic fermentation occurs naturally. Our heat stability test is Bentotest and we usually add no bentonite. The wine is not cold-stabilized; we rely on cellar temperature and time. The wine is filtered with tight DE. Free SO_2 at bottling is about 20 ppm. The wine is bottle-aged two months before release and has a residual sugar of 0.1%.

PAT PAULSEN MUSCAT CANELLI

PW: Describe your style:

Jamie Meves: Our style is dry to off-dry with light texture, forward fruit both in the aroma and the flavor without perfume. Varietal style emphasizes subtlety of Muscat. To achieve our style, we have experimented with picking between 19° and 23° Brix. Varietal character seems somewhat constant while acid balance or imbalance plays a larger part in drinking enjoyment.

This style seems most enjoyable when nothing sticks out. The correct TA range seems to be 0.68–0.72 g/100mL as tartaric. This range is edgy just after bottling but settles down nicely after 2–3 months with a pH of 3.45. Less acid is pleasant at first, but after a year, the wine seems tired and plump. More will help the basic structure of the wine to last longer, but the aromas and flavors are ready to drink much sooner and lose their freshness the older the wine gets.

Our Muscat Canelli goes well with veal sausages and red cabbage. Baked ham with a mustard-ginger glaze works well also. The wine's weight on the palate versus its intensity of aroma gives balance, as does the 0.80 g/100mL residual sugar and the 0.72 g/100mL TA.

Upon release, the wine has a simple floral estery mouth and is slightly dull and light with an edgy finish. As it develops, spiced floral aromas come through, along with a round, smooth mouthfeel with a sweetish impression. The varietal character is readily accessible. This wine serves as a good educational tool. 95% of the population likes Muscat, though they don't necessarily ask for it.

PW: Describe the vineyards:

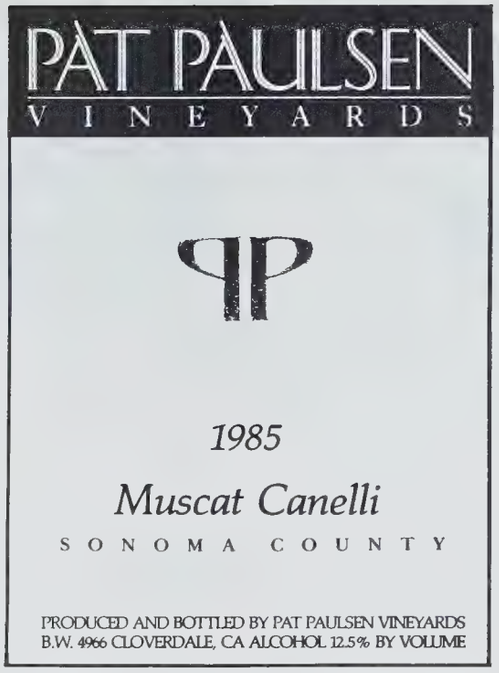
John Clendenen (Preston Vineyard): Pat Paulsen Muscat Canelli comes from Preston Vineyards in Healdsburg, CA. We have 5 ½ acres of Muscat Canelli located in an alluvial plain on the banks of Pena Creek, near its confluence with Dry Creek. Elevation is 190 feet.

The vines were planted in 1974 with 455 vines/acre on 8x12 spacing. The vineyard rows run approximately north to south. Budwood came from Wente Bros. in Livermore, CA. The majority of the block, 5 acres, is on AxR 1 rootstock. One-half acre sandy area along the creek was planted on St. George to combat drought, but resultant vigor has given excessive shatter.

We use a 7-foot stake with a 24" crossarm supporting 2 wires 14" above the cordon wire. A fourth wire was added 8" above the cordon to direct shoots upward. This gave more even shading by not allowing all of the foliage to be blown over to the east and leaving the fruit exposed to the sun. Vines are trained on a bilateral cordon with 6 shoots/side. One to two canes/vine are also left in the area with St. George rootstock to reduce shatter.

Pruning is done midwinter with 12 2-bud spurs/vine to produce an average yield of 4 tons/acre. Sucker or shoot thinning is done in the spring, reducing the number of shoots to 3 per spur. We pull off any second crop and remove leaves around the bunches for air movement.

The top soil varies from a Yolo loam to very sandy loam. Soil pH is 6.5 and the depth of topsoil varies from 2–6 feet. The majority of the block is underlain with unsorted river gravel which is very deep in some areas and as shallow as two feet in some spots.



Jamie Meves

We apply 40 lbs/acre of nitrogen in 16-16-16 before budbreak. The soil leaches fairly readily and Muscat Canelli is a variety with only moderate vigor. The entire block receives 3" of sprinkler-applied water around June 1, followed with biweekly drip irrigation only in the gravelly areas, about ½ of the block. The better soil areas of the block require only the one sprinkler irrigation, while the more gravelly areas need very frequent drip irrigation to avoid desiccation.

The lowest winter temperature was around 26°F at night for approximately two weeks in the 1985-86 season. The potential for frost damage is from April 10 to June 1, but for the past few years no frost protection has been necessary.

Budbreak occurs around April 10, with berry set about May 22 and veraison occurring around July 15–20. The highest summer temperature is 110°F on a few hot summer afternoons. If this occurs early in the growing season, it requires sprinkler heat protection to avoid top wilt.

Our Muscat Canelli block presented some interesting problems which we feel we have solved to produce a superior grape. Sunburn was an early problem with a fairly easy solution. The addition of a third foliage wire directly above the spurs keeps the shoots from blowing to the east and exposing the fruit to the hot afternoon sun. The drip system helps to keep the leaves actively shading the fruit late in the season.

Mildew had been a problem in the past but one application of sulfur dust followed by two applications of Bayleton has given us excellent control. Botrytis continues to be a problem in the lusher areas of the block because the variety has a large berry, tight clusters, and a soft skin. Fungicides have not been noticeably helpful with the exception of Captan dust. Late-season mechanical hedging and hand-removal of leaves around the bunches allow good air movement and reduce the spread of rot.

PW: When are the grapes picked?

In 1984 and 1985, Muscat was harvested in the last week of August and the first week of September. We operate in a fairly narrow Brix range of 21°–22° Brix but the most interesting characteristic of this variety is the distinct Muscat flavor which occurs when the fruit is ripe. We hand-pick and sort the grapes in ½-ton bins for transportation to the nearby winery. Rot is an occasional problem with this varietal.

The main factor telling us to 'pick now' is sugar. Number 2 is hangtime and number 3 is rot.

PW: How is the wine made?

Meves: No SO_2 is added at crush. Prior to inoculation, acid is added in the ratio of ⅔ tartaric and ⅓ malic to raise the TA to

David Pearson

0.9 g/100mL. Skin contact time is 8–12 hours at 55°–65°F. Total yield is 180–190 gal/ton. We use liquid culture Prise de Mousse with a 3% inoculum. Juice is settled for 48 hours prior to inoculation.

The fermentation period lasts 4 weeks, starting at 60°F with must at 22° Brix and gradually lowering both temperature and Brix to stop at 1.0 g/100mL residual sugar. Juice lees are filtered and added to white table wine. First racking off the yeast lees is just prior to stopping fermentation, at 2° Brix. Fermentation is stopped by refrigeration, fining, and DE filtration. We rack again after bentonite fining of 3 lbs/1,000 gal. Cold stabilization occurs afterward by holding the wine at 30°F for 6–8 weeks.

The wine is filtered at the end of November or early December. One filtration utilizes tight DE, one is with sterile pads, then 0.45μ membrane to bottle. Free SO_2 at bottling is 30–35 ppm; total is less than 110 ppm. The wine is bottle-aged 3 months before release.

SAN PASQUAL MUSCAT CANELLI

PW: Describe your style:

David Pearson: Our style is a sweet, low-alcohol (8–9%) dessert wine, balanced with acidity. It is light, fruity, and very varietal. We achieve this with a slow, cold fermentation. Our wine is recommended with almost all pastry desserts, such as apricot tarts.

The wine's characteristics upon release include a spicy, floral, distinctly Muscat aroma with hints of honey. It is very clean and light. At optimum maturity, it is a little more balanced with better blending of flavor components. Residual sugar is 6–7 g/100mL and total acidity is 0.8–0.9 g/100mL. The wine should cellar well for up to 3 years.

PW: Describe the vineyards:

We purchase grapes from Tepusquet Vineyards in Santa Maria Valley, and also own 6 acres in San Pasqual Valley. Estate vines are spaced 6x10 for 495 vines/acre. Trellis system is bilateral cordon with a 2-wire trellis with eventual 2-wire 'T' trellis to give canopy support. All pruning is completed in January/February. Four to six 2-bud spurs are left. Average crop yield is 2 tons/acre or slightly more.

Soil is sandy loam with a 3'–4' topsoil. The vineyard is fertilized in split applications in January and May. Rain may leach some of the urea out of the root zone so we split the applications. We fertilize with urea at 50 lbs actual per acre.

Annual range of degree days in our region is 3,500–3,700. Rainfall during growing season is almost non-existent, with only 3" annual rainfall. A drip irrigation system is used. We add 18'/season, divided into approximately 10 irrigations/month from March to October.

Budbreak is about the first week in March. Berry set occurs around the end of May, with veraison the first two weeks of July.

PW: When are the grapes picked?

Grapes are hand-picked when we get the desired Brix, 22.5–23°.

PW: How is the wine made?

Acid adjustments at the crusher are made with tartaric to achieve 1.10 g/100mL. No SO_2 is added at crush, but 50 ppm is added prior to fermentation, along with 4 lbs/1,000 gal bentonite, and is maintained at 25–30 ppm free after fermentation. Grapes receive 8 hours skin contact at ambient (70°F) temperature. Total yield is 165–170 gal/ton. Juice is settled and centrifuged before inoculation. Settling is at 35–40°F for about 5 days. We use active-dry Prise de Mousse at 4% inoculum.

The fermentation period is 2–3 weeks. We chill down to stop fermentation at about 6–7° Brix and centrifuge immediately. We rack once or twice more after fining and stabilization treatments.

Our heat-stability test is 50°C for two days. Bentonite and sparkalloid are then added at 2 lbs/1,000 gal. Cold stabilization occurs after fining and rough-pad filtration. Wine is chilled to 30°F for 5 days.

We do a sterile pad filtration before bottling. There is a 0.45μ membrane in line at bottling. Total SO_2 at bottling is 125 ppm and free is 25 ppm. The wine is bottle-aged 2–6 weeks before release.

DE BAUN SYMPHONY

PW: Describe your style:

Jamie Meves: We attempt to de-accentuate phenolics. In 1986, we plan to press whole clusters to accomplish this. Symphony, a cross between Muscat of Alexandria and Grenache, was specifically bred at UC Davis to de-accentuate Muscat's varietal bitterness. We try to take this one step further with our winemaking techniques.

Symphony's varietal character of brandied oranges and tart bananas comes through when the wine is young, and develops into a fruit salad ambrosia character later, according to UC Davis. The wine can age up to seven years and develops some Chardonnay-like characteristics when older.

PW: Describe the vineyards:

20 acres of Symphony were planted by Mel Sanchetti north of Santa Rosa, CA, in 1982 on AxR 1 rootstock. Vines are cordon-pruned and produced 3.4 tones in 1984 and 58 tons in 1985.

PW: When are the grapes picked?

Grapes for the dry-style Symphony were harvested about mid-September at about 21° Brix, with grapes for off-dry/sweet Symphony being harvested up to mid-October at about 23.5° Brix.

PW: How is the wine made?

No SO_2 is added at the crusher. In the past two years, the must has received eight hours skin contact at 65–75°F. Three lbs/1,000 gal bentonite is added to settle juice. Acid adjustments are made to 0.90 g/100mL tartaric to lower pH.

Juice is settled and racked after 48 hours at 40°F. The must is inoculated with liquid-culture Prise de Mousee 3% inoculum. Sweet Symphony was fermented five weeks. Fermentation temperatures range from 45–60°F.

Additions of bentonite and PVPP are made prior to arresting fermentation of sweet Symphony, which is done by turning the chiller to 28°F at 9° Brix. Tartaric (1–3 lbs/1,000 gal) and 75 ppm SO_2 are added at this time, along with 2 lbs/1,000 gal bentonite and 1 lb/1,000 gal PVPP.

Heat stabilization is done about 6 weeks prior to bottling and has involved a final addition of about 1.5 lbs/1,000 gal bentonite. Following this, the wine is cold-stabilized by holding the wine at 30°F for 2 weeks, then is tight-DE-filtered and sterile-pad-filtered before bottling. There is a 0.45μ membrane at bottling.

MUSCAT WINEMAKING SUMMARY
MAY–JUNE 1986

WINERY	HARVEST CRITERIA	SKIN CONTACT HRS. & TEMP.	JUICE TREATMENTS	YEAST/PEAK FERMENTATION TEMPERATURE (Juice)	ACID ADJUSTMENT	BENTONITE FINING LEVELS	FILTRATION
De Baun (Symphony) *Jamie Meves*	dry: 21° Brix sweet: 23.5°Brix	8 hrs. 65–75°F	none	3% liquid culture Prise de Mousse 45–60°F	tartaric to 0.90 g/100mL to lower pH	3 lbs/ 1,000 gal	DE + sterile pads +0.45μ at bottling
The Eyrie Vineyards *David Lett*	17.5° Brix 0.60–0.65 TA 3.3–3.4 pH	none	pectic enzyme	2% freeze-dried Pasteur Champagne	citric	none	tight DE
Jekel Vineyard *Rick Jekel*	20–21° Brix 0.90–1.20 TA 2.9–3.2 pH clean fruit, some botrytis preferred	6 hrs. 45°F	none	5% liquid Steinberg 35–40°F	none	2–4 lbs/ 1,000 gal	DE + 0.45μ at bottling
Pat Paulsen Vineyards *Jamie Meves*	20.5–22.5° Brix 0.70–0.90 TA 3.1–3.5 pH	8–12 hrs. 55–65°F	pectic enzyme	3% liquid Prise de Mousse 55°F	tartaric + malic to raise TA to 0.90 g/100mL	5 lbs/ 1,000 gal	tight DE + 0.45μ at bottling
Robert Pecota Winery *Robert Pecota*	25° Brix	none	none	3% freeze-dried Epernay 50°F	none	2–4 lbs/ 1,000 gal	tight pad
Quady Winery *Andrew Quady* *Mike Blaylock*	19–23° Brix 0.50–0.70 TA 3.5–3.7 pH	varies	none	2% freeze-dried Montrachet 60°F	tartaric + malic to raise TA + lower pH	2–4 lbs/ 1,000 gal	tight pad + DE
San Pasqual Vineyards *David Pearson*	20–24° Brix 0.50–0.75 TA 3.13–3.54 pH flavor	8 hrs. 60°F	none	4% Prise de Mousse 50–55°F	tartaric to 1.10 g/100mL	4 lbs/ 1,000 gal	0.45μ at bottling
Shenandoah Vineyards *Leon Sobon*	23–24.5° Brix 0.60–0.72 TA 3.3–3.6 pH color, flavor	60–65 hrs. 80–85°F	none	1% Montrachet 80–85°	tartaric to raise TA to 0.70 g/100mL	none	

Muscat Tasting Notes

PW *thanks Silverado Restaurant, Calistoga, CA, for hosting the tasting.*

Kathy Joseph, *Robert Pecota Winery*
David Lett, *The Eyrie Vineyards*
Diane Mayfield, *PRACTICAL WINERY*
Jamie Meves, *Pat Paulsen Vineyards*
Don Neel, *PRACTICAL WINERY*
Robert Pecota, *Robert Pecota Winery*
Leon Sobon, *Shenandoah Vineyards*

Eyrie 1984 Muscat Ottonel

Pecota: Very distinctive, but closed—I couldn't get any aroma.

Lett: It's more like a European—German or Alsatian—wine.

Pecota: I agree, it has very light Muscat aromas. It's clean, but I find the wine to be a little too watery and thin for my own palate. It's a clean, well-made wine, but I would have a very difficult time distinguishing it as a Muscat. It could be a Riesling.

Joseph: I thought it had some nice perfume. I thought it was clean, although it was low-intensity. I found it to be somewhat attractive, although I also thought it was a little bit light, low acid, and a little bit low in body. I'd like to see a little more residual sugar, which might emphasize the fruit on the palate.

Pecota: Did this see wood, David?

Lett: No.

Meves: I thought it was fairly intense, actually. I got a lot of intensity in the nose, mostly floral, with a touch of a resiny, piney sort of aroma. The mouth seemed young and like it hadn't been that long since fermentation. It was zippy and had a nice little bit of CO_2. The finish was full and rounded, the acid seemed well-resolved with a touch of bitterness. I think my biggest comment on this wine is that this is definitely something that needs to be accompanied by food. This is not a Sunday-sipping Muscat.

Neel: What about the bitterness? Did you fine this at all?

Lett: No. When the wine was first bottled, there was bitterness, but I don't get it now. It's interesting that we had this wine at a tasting previously, and some people found it very acidic.

Meves: I thought it was sort of medium acid.

Pecota: I didn't complain about the low acidity, I just wanted more intensity in the wine.

Lett: I have a problem with this variety. It's very easy to make it more intense; I'm trying to tone it down, because when you get all the varietal aroma of Ottonel, it's unreal. I don't like the varietal aroma myself.

Pecota: Does it have a Muscat aroma or is it Riesling-like?

Lett: No, it has a Muscat aroma.

Neel: Do you pick all at one maturity, or do you pick in different lots so you might get different qualities?

Lett: All at once. It's a matter of logistics, because it comes in very early. I mean, even in Oregon, it's our earliest variety.

Pecota: What is the residual? It's under one, isn't it?

Lett: Yes, it's dry. I looked at about 70 different Muscat varieties at UC Davis when I was there years ago. By the time they were fermented to dryness, their character was gone. I discovered this variety in Alsace. They're currently phasing it out in Alsace because it's such a capricious producer. In fact, we lost our entire 1983 crop because of shatter.

Neel: So there's high shatter potential?

Lett: Oh, yes. That's a general characteristic of Muscat.

Color/Aroma: Pale straw; clean, light Muscat aromas, some piney, spicy notes.

Flavors: Light, medium acid, watery, some fruit, clean but very thin.

Finish: clean, austere, slightly bitter.

Pat Paulsen 1981 Muscat Canelli

Pecota: It's got a nice light color and a nice orange-blossom aroma. I think it's getting a little bit tired, slightly bitter, but I liked its balance very much. It has some spiciness to it, which I think is characteristic of good Muscat. It had a nice balance in the finish, but I thought it was a little bit old, a little bit tired.

Joseph: I really liked the flavor. It reminded me of lychee nuts, tropical fruit . . . I really enjoyed it. I liked the balance—I like having that hint of residual sugar.

Pecota: I thought this had very clear varietal tones. I mean, this is really well-defined Muscat Canelli. Very well made, good finish. The sweetness was a little bit too much for me.

Sobon: I found the aromas just beautiful, just big, full, enormous. A little bit of age shows in the aromas, though I didn't notice it in the taste. Age gives it sort of a stinkiness, I don't know how to describe it. Something happens when Muscat ages.

Meves: I get sort of a candied, oxidized character.

Sobon: Maybe it's just the oxidation. It's not really stinky, not like sulfur-stinky.

Meves: No, but it's a dried-out quality. The people who loved this wine when it first came out, if you taste them on it now, they probably wouldn't like it. It does show the age. When this wine is fresh, it'll knock your socks off. It's not cloying, but you just want to keep on drinking it.

Lett: What is the residual on this?

Meves: 0.87 g/100mL. The alcohol is 12.3%. These grapes were picked at 22.5° Brix.

Color/Aroma: Straw; lychee nuts, tropical fruit, candied, some oxidation.

Flavors: Flavors agree. Aged but not oxidized.

Finish: Long finish, good balance. Slight residual sugar apparent.

San Pasqual 1984 Muscat Canelli

Sobon: I thought it was a bit subdued. It was a late-bloomer—the aromas came out later. I got a pineapple aroma. I thought the flavors were good, although it was a bit sweet. It had a different flavor from the aroma—I thought more of a dried-pineapple flavor.

Pecota: I agree. The aromas were nice, but they were not typical Muscat. They were flowery, but not fruity. None of the peach and apricot that I look for in a Muscat aroma. It was clean, sweet, with a little bit of bitterness. This wine, to me, tasted significantly acidified; it had a lot of acid in it.

Sobon: It tastes like a Muscat would in Germany—I would identify it as a German Auslese.

Joseph: A honey character is how I described the fruit. I'm thinking along botrytis lines, although I know we have a hard time getting botrytis in our fruit. I felt it was a little bit on the sweet side, although I liked the viscosity of the wine, but I thought the sugar was a little bit too prominent.

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Meves: I get kind of a sourness in the nose, and honey, too, perhaps some botrytis. There were definitely some good floral aromas behind it. In the mouth, to me, of the bunch, this one was the most interesting, because it did have the sweetness, but it had a real nice acid that cut through the sweetness and defined it, made a nice balance between sweet and tart, sort of like a good fruit salad. The basic balance was a little citrusy without the tartness.

Color/Aroma: Straw; honeyed, botrytis character, citrusy, flowery.
Flavors: Full, rich, sweet/sour balance, honey, dried pineapples.
Finish: Lingering finish, clean, sweet.

De Baun 1985 Symphony (0.80 g/100mL r.s.)

Lett: I got a mild Muscat aroma, more orangy than citrusy.

Sobon: Personally, I find that Canelli has a very pineapply aroma, and that Muscat of Alexander seems to have an orangy character. And I find that in here.

Pecota: I felt the same way. Some Muscats have a light pineapple. This very much reminds me of Emil Tedeschi's Maui Blanc. It's got the same balance and the same kind of character. Again, I think it's a little thin, with a little bitterness that's characteristic of the variety, and the finish was a little short.

Meves: That's strange, because this is a variety that was bred to have no bitterness.

Neel: You still have the option of fining it to try to remove some of that bitterness. Was it fined at all?

Meves: With PVPP. I find it a little yeasty. What we tried to do with the grapes was to take it down as dry as we could without really committing ourselves to bone-dry, which was about 0.76 g/100mL. It is a touch bitter, but it's not nearly as bitter as it was before it was filtered. It was cloudy until a tight-DE-filtration was done. The difference in bitterness was night and day, it decreased so much. What we plan for the future is to go to whole-cluster pressing and see if we can eliminate some of the grinding and so forth, and minimize phenolic pickup as much as possible.

Color/Aroma: Straw; subdued varietal notes, yeasty, floral, citrusy.
Flavors: Dry, pineapples, pears, good mouthfeel.
Finish: Good balance, finish a bit short, some bitterness.

Pat Paulsen 1983 Muscat Canelli

Mayfield: I agree with Kathy when she said she picked up that lychee nut character in both the Paulsen wines. I got exactly the same thing. There's a real similarity in the aromas of both wines.

Pecota: I got light flavors and just a slight volatile tone, but very well-balanced, clean, lingering finish—a nice sipping Muscat.

Sobon: I found the same stylistic similarities between the two Paulsen wines.

Meves: It's probably a vineyard rather than a style. The big difference between the two wines is that the first one had about 3.2 pH and this one is 3.45.

Color/Aroma: Yellow; lychee nuts, Muscat floral tones, stylistic similarity to previous Paulsen wine.
Flavors: Dry, light flavors, medium fruit.
Finish: Slight bitterness, short finish, clean.

Jekel 1981 Muscat Canelli

Neel: So far, we've had geographical representation among these wines. We've had Sonoma County, San Pasqual down south, and now here's a Monterey County wine. Is there a difference by region, and what is the difference?

Pecota: Absolutely, there's a difference. There's a definite vegetal character in this wine; it's a Muscat vegetal character that is different, but it's characteristic of the grapes grown in that area. It's sweet, slightly low in acid, somewhat flat, but has very long, lingering flavors. I think this is probably the most powerful wine in the flight. It's the sheer power, total aroma and total flavor, that does it. I would like the wine better if it were a little bit higher in acid. If the vegetal character is not off-putting to a person, then I think it's a very delightful wine.

Lett: I think that's Canelli oxidized. I get a lot of oxidation out of that wine. I think what you're calling vegetative, I would call vegetative, but I think it's defined by oxidation of the Muscat aromas. This is my least favorite of the bunch—it's a little flabby and the sugar is a little cloying, but it does have a nice finish and I like that. The oxidation is hard to get by.

Sobon: I found it aged. It had an aged aroma.

Joseph: To me, it was the most closed wine of the group, and I thought of

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it as a more delicate style. I got a light mushroom character and a slight oxidized character. I thought it was lower in acid, but I thought it was well-balanced with residual sugar. It reminded me of a pear wine.

Color/Aroma: Yellow; vegetal, oxidized, light Muscat aromas.

Flavors: Sweetness somewhat cloying, low acid, some tropical fruit.

Finish: Flat, long finish.

Pat Paulsen 1982 Muscat Canelli

Sobon: It has an aged Muscat aroma. It's showing a little bit of bitterness. I thought it aged well, but not great.

Neel: Bitterness is not an ageing factor.

Sobon: I think it shows up later.

Joseph: I think sometimes when the fruit drops off, the alcohol becomes more prominent, and sometimes leaves a slight bitter feel on the palate. So it's not an actual bitter component; it's more of an impression. I thought it had some nice fruit, with a pineapple aroma, fresh and clean with medium intensity, but with that astringent character in the mouth, the alcohol did tend to dominate. It didn't have all the fruit I'd like to see, but I thought the aromas were fresh and clean.

Pecota: I liked the wine; I found it quite spicy and clean, with well-defined flavors, good balance and a nice, lingering finish. I thought it was holding up quite well.

Mayfield: Jamie, were the grapes rained on that year before harvest? I enjoyed the aromas a lot, but on the palate, I found it a bit thin and watery. Could all that rain we got in 1982 could have caused this?

Meves: Maybe, I don't remember exactly what happened, but I remember that we pulled these in, and they weren't as ripe as the year before, and the fermentation went further than the other one, so the alcohol is a little higher and the sugar is a little lower, so that may have unmasked the bitterness you're picking up there. I don't know if you can pick up the difference between 0.73 and 0.86 g/100mL residual, but the alcohol's a little higher.

Color/Aroma: Straw; fresh, clean pineapple aromas.

Flavors: Some fruit, slightly flat, alcohol dominates, sweet, spicy.

Finish: Slightly hot, bitter finish.

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Jekel 1984 Muscat Canelli

Lett: I thought this had very clearly-defined Muscat tones; it was a bell-ringing Muscat. It has a tight structure, good balance, and good finish. I thought it was a lovely wine.

Pecota: I agree. I think this wine, more than any we've seen so far, shows that real nice apricot character that Muscat can have—a ripe Muscat character. I thought it was a very nice wine.

Joseph: I think this wine's going to age well. My feeling about this wine is that it's probably a lot sweeter than the impression it leaves on the palate. It's nicely balanced. It had a dry finish. It tastes sweet, but it's not cloying. I enjoyed this wine.

Sobon: I thought the aromas were very subdued. I thought the flavors were, too. It had good sugar and good acid, but I didn't get a lot of body.

Meves: I thought it was good, clean, right-down-the-middle Muscat, safe, excellent example of young Muscat. It was very similar, although the character's somewhat different, to the 1985 San Pasqual Tepusquet. It's also what I think I've found in our Muscats. The first year that it's made and bottled, it tends to have a real nice fresh apricot character, and it dries out after it's been aged. I think this wine's as good as it's ever going to be in terms of its freshness.

Joseph: Meaning that it's going to fall off as it ages?

Meves: No, it's going to change. The freshness and youth of the fruit is going to change to a more oxidized, candied aroma.

Color/Aroma: Straw; clear, defined Muscat nose, orange blossoms.

Flavors: Apricots, pineapple, sweet, clean.

Finish: Well-balanced, good structure, long finish.

San Pasqual 1982 Muscat Canelli

Pecota: Here, I thought that definite oxidation was showing up. It's lost its attractiveness as a Muscat. It's quite sweet on the palate, sugary, flavors are oxidized, low acid, long, lingering finish, but a little cloying to me.

Neel: Is it objectionably oxidized?

Sobon: Noticeably, but not objectionably. I'd call it big, ripe, and oxidized, with the aroma of dried peaches and pears.

Pecota: I wouldn't mind drinking this wine with dessert at all, but I do think it's lost its attractiveness. I think it must have been a much more attractive wine a year or two younger than it is now.

Meves: I think the grapes were probably quite ripe.

Lett: It's not typical of Canelli. That's why I asked you if it was Canelli; it's not what we've gotten out of the other Canellis. I thought the acid was like someone made a mistake and put an extra bag of citric in. It was annoying to me, the acidity, but it was too sweet, also.

Color/Aroma: Yellow; oxidized, honeyed, some botrytis, peaches, pears.

Flavors: Sweet, tropical, pineapples.

Finish: Flabby, low acid, long finish.

San Pasqual 1985 Muscat Canelli, Tepusquet Vineyard (tank sample)

Sobon: Very different Muscat aroma. More citrusy, orangy, than pineapply.

Lett: Yeah, I found it very carbonate in the mouth.

Sobon: It must be the growing area.

Neel: That's what I found when I first tasted it out of a tank at the winery two months ago. The Tepusquet was different from any other Canelli I'd tasted. It is unique.

Sobon: It smells like an Orange Muscat. It's got a pleasant taste, very nice.

Pecota: I see some similarities between this and the Jekel.

Color/Aroma: Yellow; perfumy, orangy, clean.

Flavors: Tart, CO_2, citrusy.
Finish: Well-balanced, long finish.

Robert Pecota 1982 Muscato di Andrea

Sobon: I thought it had very ripe, tropical aromas and sweet, candied flavors with a very long finish. Were the grapes very ripe?

Pecota: We pick right between 24 and 25° Brix, 25.5° sometimes.

Sobon: Do you get sunburn?

Pecota: Very little. Sunburn on a Muscat cluster usually affects the entire cluster, so it's just left behind in the field. So you don't get very much sunburned fruit in.

Meves: I get clean, full-blown, melony pineapply aromas, and real up-front flavors. The nice thing about this wine was that the entire package was consistent. The intensity, the flavors, the aromas were all consistent, and the balance was really nice. There was no letdown between the aromas and the flavors and the finish.

Lett: If I put this on a scale of Riesling to Muscat, I'd put it more on the Riesling side. It's pleasant, though—I love it.

Pecota: Yeah, it has that pineapply, melony character.

Lett: I thought it was a little bit too sweet on the palate.

Pecota: Yeah, my main criticism of the wine was that it's slightly low in acid in relation to the sugar. It is very pleasant and melony, and goes down very easily, but I'd like to see a little bit better balance with better acid. Bottling acid was about 0.80 g/100mL, sugar 8.6 g/100mL, and alcohol about 9.3%.

Lett: What kind of acids do the grapes come in at?

Pecota: We're getting acids between 0.70 and 0.80 g/100mL, and then we acidulate.

Joseph: For a more aged Muscat, I found the acid to be pretty acceptable. It had a citrusy taste and still had a little life to it—I enjoyed tasting it. I thought it showed age in that it had a slight mushroom character, and also I described it as melony. But I thought the acidity was better than I would have expected.

Pecota: It's got an aged mellowness to it. I don't think we should look for acid to stick out when a wine has reached its peak.

Joseph: Except that it can be flabby.

Color/Aroma: Yellow; pineapples, melons.
Flavors: Clean, forthright, sweet, candied.
Finish: Low acid, lingering finish.

De Baun 1985 Symphony (3.9 g/100mL r.s.)

Pecota: Quite clean, very attractive, pleasant, light flavors, with a little sparkle. A little lighter finish, but overall an attractive, pleasant, Spatlese-style.

Joseph: I got some very nice flavors in it. It was medium-intensity, it wasn't a real knockout, but I really enjoyed the balance. I really like it.

Lett: I like it *because* it wasn't a knockout—it didn't come up and slap you around the head and ears. It was a pleasant, well-made wine.

Sobon: I loved it, I thought it was great. It didn't have the Canelli aroma, it had the other Muscat aroma. Nice flavor, nice balance. I just loved the finish.

Color/Aroma: Straw; fruit salad, apricot, medium intensity.
Flavors: Tart, CO_2, pineapples, apricots.
Finish: Crisp, clean finish.

Robert Pecota 1985 Muscato di Andrea

Lett: I would put this wine more on the side of Riesling. I think the palate feels incredibly good, perfect structure, really nice wine. By saying that it's leaning toward Riesling, that means I like it.

Meves: This has a youthful tartness to it that, when we were talking about the 1982, the '82 had such a nice mellow feel to it, I think this will follow that.

Sobon: I get pineapple aromas, Muscat aromas. I found it rich and fat in the mouth, but very tart at the same time. Very nice balance.

Joseph: One of the things this wine had going for it was that the acid was good in the grapes and it didn't drop out during fermentation.

Sobon: It was a good year for white grapes. Did you have to add acid to this?

Joseph: Minimal, and it was all added early, at the juice stage. I find that the later you add it, the more prominent it becomes.

Sobon: What kind of tonnage did you get?

Pecota: Well, the grapes come from three vineyards. One vineyard is very young, so we got about 1.5 tons/acre. This year wasn't very good in our two main vineyards—we got 3.5 tons/acre, maximum. Actually, the one in Alexander Valley only yielded about 2.5 tons/acre—he had a lot of shatter.

Meves: This has good sugar/acid balance.

Joseph: This has 10 g/100mL residual sugar. TA is 1.2 g/100mL and alcohol is 9.2%. Actually, I was aiming for 9x9, sugar to TA, but the flavor tasted so good and balanced that we decided to stop it there.

Color/Aroma: Straw; pineapples, melons, apricots.
Flavors: Rich, tart, peaches, pineapples.
Finish: Smooth finish, good sugar/acid balance.

Shenandoah 1985 Orange Muscat

Lett: I get alcohol.

Pecota: There's something to be said for the need for alcohol fortifications to meld. In a very young wine, like this one, the alcohol tends to hang out. No matter how clean or high-proof it is, you'll still see bitterness for a while.

Lett: It's got a nice orange-peel aroma.

Meves: The aroma's real nice.

Joseph: Overall, I found it very fresh, and I enjoyed the orange-peel quality. I thought the alcohol/sugar balance was just right. My impression was

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that it wasn't too hot, it wasn't too sweet. If anything, it was maybe a bit low in acid, but I liked the finish. I enjoyed it very much.

Neel: Not to jump ahead, but when you talk about needing time for the fortification to meld, that's what I notice in the two Essensias. The older Essensia is much more integrated.

Color/Aroma: Pale orange; orange peel, raisins, alcohol.

Flavors: Alcohol dominates; butterscotch, brandy component, candied, melony.

Finish: Somewhat hot, bitter finish.

Quady 1984 Essensia

Joseph: I picked up a vegetative hint and a slight medicinal quality, but I liked the dry finish to it. There seemed to be a heavier quality in the aroma than the Shenandoah.

Lett: I got a vegetative quality—I called it herbaceous. And it was medicinal on the palate, almost like cough syrup.

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Pecota: There is a little bit of a cough-syrup character typical to this style of wine. I think if you like that character, and many people do, then you're accepting that character. I think this wine has well-defined sweetness, kind of a piney character. I would say there's a significant difference in the two vineyards here. They're both the same grape, Orange Muscat, but there must be a significant difference between Madera and the foothills.

Meves: It seems to me that Madera does tend to emphasize more of the grapefruit character. I get a fusel oil character from the spirits.

Sobon: Andy Quady selects his grapes differently from me. I select mine for floweriness and almost lack of flavor. Andy likes more character. He picks the ones with more fusels.

Color/Aroma: Orange; musty, sweaty leather, herbaceous.

Flavors: Solvent, fusel oils, sweet, medicinal, vegetal.

Finish: Somewhat disjointed, bitter, clean.

Quady 1982 Essensia

Lett: This is what I've come to expect from Essensia. I call it 'Quintessensia'.

Sobon: You better copyright that before Andy gets hold of it!

Pecota: I get strong fruit definition, almost botrytis-like. Long finish. It has an overripe-apricot flavor and adequate balance. I like it; I prefer the 1982 to the 1984.

Sobon: It has a faint vegetative character, but it's more toned down, more in balance.

Color/Aroma: Dark orange; apricots, cooked oranges, vegetative.

Flavors: Apricots, botrytis, aged character.

Finish: Rich, lush, full finish, good balance.

Shenandoah 1984 Black Muscat

Lett: It has the most incredible floral nose I've ever gotten out of a wine in my life. Just amazing.

Sobon: What kind of character?

Lett: Violets.

Pecota: This may sound strange. It's not barbecue, but it's so floral that I get almost burnt wood.

Sobon: This was barrel-aged in new wood.

Meves: Dried rose petals is what I wrote down.

Joseph: I described it as ripe figs. It isn't raisins and it isn't fruit—it's figs. I liked it.

Pecota: It's a rich, plummy wine, which to me initially was a little off-putting—I wasn't ready for the tannin. But I agree, it's not fruit-based at all, it's flower-based.

Meves: What sort of food do you recommend this with?

Sobon: Cheese, nuts.

Color/Aroma: Violet; figs, rose petals, berries, burnt wood.

Flavors: Flavors agree, plummy, tannic.

Finish: Slightly hot, bitter, long finish.

Shenandoah 1980 Black Muscat

Sobon: This shows more of a change in winemaking style rather than how the wine will age.

Pecota: This is a nice Port style, not Muscat really, but Port-like. Tannins are the only thing that stick out to me. They dominate the overall palate feel.

Lett: I start with the aroma, and I don't think it's typical Hamburg.

Meves: I think it's a little tired.

Lett: Yes, and it smells a little tanky.

Sobon: This particular bottle didn't age very well; I'm not sure what it was. The other ones I've opened in the past are not like this. I started out making Ports before I started making wine. I like Ports, so I made this in a Port style. It's about 10% Zinfandel pressed very hard and fermented very hot.

Lett: What other varieties are in there?

Sobon: Just Zinfandel and Muscat Hamburg.

Lett: I don't get much Muscat out of the nose.

Sobon: No, it's gone.

Color/Aroma: Violet; spicy, Port-like, Zinfandel, tired, tanky.

Flavors: Tannic, thick, viscous, Port-like.

Finish: Hot, dull, tannic.

Phosphorus Deficiency Found in California Vineyards

Stephen Krebs

Another phosphorus-deficient vineyard has been found. This one is located near Healdsburg, CA, in Sonoma County. Fred Peterson, managing partner for Hambrecht & Peterson Vineyards, and who studied the mineral nutrition of grapevines with Dr. James Cook at UC Davis, first suspected a phosphorus deficiency in mid-summer 1985. Peterson had noticed that 2- and 3-year-old hillside Cabernet Sauvignon, Merlot, and Cabernet franc vines under drip irrigation were growing poorly.

"The vines had enough water, and nitrogen levels in the vine were fine, but after normal spring growth the internode length got shorter and the leaves got smaller," said Peterson. "The basal leaves turned yellow and fell off, and the mid-cane leaves showed distinctive red bars.

"Tissue analysis confirmed my suspicion of phosphorus deficiency. I applied a liquid form of monoammonium phosphate (10-34-0) at the end of August through my drip irrigation system, and after approximately three weeks, the vines began new strong growth."

For many years, it was believed that no phosphorus deficiency existed in California vineyards. In numerous field trials, University of California researchers had failed to produce yield increases with the addition of phosphorus fertilizers. Dr. Cook, Professor Emeritus of Viticulture at UC Davis and one of the foremost authorities on mineral nutrition of grapevines, had been predicting that phosphorus deficiency would eventually appear in California vineyards.

"With all the interest in new viticultural areas, it was only a matter of time before a grower would plant grapes on a soil that has no phosphorus for grapevines," stated Cook. "As it turned out, we now have worked with several growers scattered around the state whose vineyards have responded to our trial applications of phosphorus."

In particular, interest in hillside viticulture has led to greater utilization of marginal soils, and it is on these sites that grapevines have begun to show symptoms of phosphorus deficiency. The first reports of phosphorus deficiency in California vineyards were made by Cook in 1983, all from hillside vineyards on acid soils in the Sierra and Coast Range foothills. As more of these deficient vineyards have been found, the symptoms have become more widely recognized. In a recent interview, Cook indicated that as many as 10,000 acres of recently-planted vines might be on soils where there is a potential for phosphorus deficiency to occur.

"We don't expect to see this deficiency on valley soils, where we never got a response in the past. It's the acid soils in the new areas being planted where we expect to find more cases of deficiency in the future," he emphasized.

Phosphorus in the Soil

Different soil types have various total amounts of phosphorus. Not all of the total phosphorus is available for plant uptake, however.

Phosphorus in the soil occurs in organic and inorganic forms.

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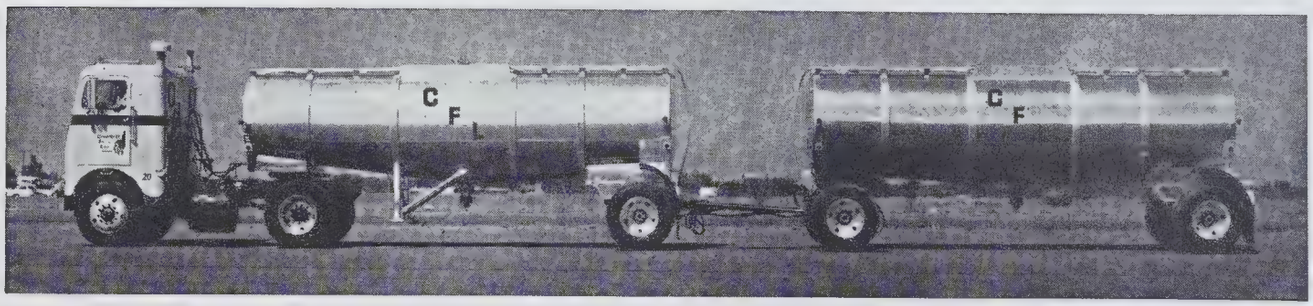

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The organic portion is found in humus and the associated organic materials. The inorganic portion is found in many combinations, with calcium, iron, aluminum, and other elements, and these compounds are usually only very slightly water-soluble. In addition, phosphates react with the clay fraction of soils and form insoluble complexes.

Phosphorus available for uptake by plant roots is found in the soil solution, the water and dissolved minerals in the spaces between soil particles. The two main forms of available phosphorus in the soil solution are the primary and secondary orthophosphate ions, H_2PO_4- and HPO_4^{2-}. A minor source of available phosphorus consists of soluble organic phosphates, but these are absorbed in very small quantities.

Concentration of these ions in the soil solution and the ability of the soil to maintain this concentration as plant roots remove phosphorus greatly determines the amount of phosphorus the plant will absorb.

Availability of phosphorus is influenced by several factors, including total amount of phosphorus in the soil, the extent of contact between the inorganic fraction and the soil solution, temperature of the soil (warmer soils have more microbial action, freeing phosphorus), and soil pH. Maximum availability of phosphorus occurs between 6.5 and 7.0 pH. On very acidic soils, phosphates form insoluble iron or aluminum compounds. On very alkaline soils, insoluble calcium compounds are found. In California vineyards, deficiencies have been found only on very acid soils.

A number of interactions between phosphorus and other elements have been observed. It appears that increased uptake of phosphates occurs when ammonium nitrogen is added with the phosphate fertilizer. Where levels of calcium or magnesium are very high, uptake of phosphorus is reduced. In soils with high levels of phosphorus, reduced uptake of magnesium or zinc may occur. In soils with high levels of phosphorus and copper, suppression of iron uptake occurs on certain crops. Some plants may have reduced boron uptake on acid soils with a high level of total phosphorus.

Zinc deficiency has been observed in vineyards planted on so-called 'corral spots', ground previously used for confining animals, and that has thus had a large input of manure. It is believed that the high levels of phosphorus added by the manure cause lower uptake of zinc. Zinc deficiency has been induced by the heavy addition of manure on sandy soils inherently low in zinc. Again, it is believed that the high levels of phosphorus from the manure prevent good uptake of zinc.

Phosphorus deficiency is also seen in grapevine nurseries after the soil has been fumigated with methyl bromide. A class of soil organisms known as mycorrhyzal fungi, which aid in making phosphorus available to plants, is destroyed by fumigation. The loss of these organisms results in low levels of available phosphorus. Zinc availability is also reduced by the destruction of these fungi.

Phosphates in the soil also promote the growth and development of soil organisms. In particular, bacteria and earthworm populations are higher with sufficient phosphate, and as a result soil structure and nutrient availability are also improved.

Phosphorus and Plant Physiology

Phosphorus, along with nitrogen, potassium, magnesium and calcium, are classified as macronutrients, meaning that the plant has a need for relatively large amounts of these minerals. In most plants, including grapevines, phosphorus occurs in much smaller amounts than the other macronutrients.

Most of the phosphorus absorbed by plants is in the primary orthophosphate ion form, and much smaller amounts are absorbed as the secondary form of the ion. This happens because there are approximately ten times as many absorption sites on plant roots for the primary orthophosphate ion as there are for the secondary ion.

Once inside the plant, phosphorus is very mobile, and when in short supply it is moved by the plant from older tissue to the actively growing meristem regions. Its major roles in plant physiology are as structural compounds, such as nucleic acids and phospholipids, and in energy metabolism, where it is used to drive chemical reactions in the plant.

It is now believed that the initial receptor of light energy after it is absorbed by the chlorophyll pigment is the phosphorus-containing compound ATP. ATP helps plants store and utilize energy from photosynthesis. This energy is used to perform many functions in the plant.

Determining the Need for Phosphorus

Visual symptoms of serious phosphorus deficiency on grapevines are quite striking, and not easily confused with other mineral deficiencies. However, a mild deficiency usually results in overall reduced growth, which is not so easily detected. It is necessary to compare laboratory results with visual symptoms in order to get a positive identification of phosphorus deficiency.

One of the early signs of a deficiency of phosphorus is that the basal leaves become dark green. This initial symptom is similar to an excess nitrogen condition, but in phosphorus deficiency these leaves later turn to a dirty brown color along the leaf margins, and finally die completely. An important identifying feature on these leaves is the presence of distinctive red dots and bars spread over the entire leaf surface. Unlike other abnormalities such as leaf roll virus, where only red varieties show red leaf coloration, with phosphorus deficiency both red and white varieties exhibit this distinctive coloration pattern. The formation of very small leaves may also occur, along with abnormally slow and generally weak vine growth.

Fruit symptoms are especially noticeable, with berries setting

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only at the tips of the clusters. This can cause a very serious loss of productivity, because only a small percentage of the flowers form normal berries. Combined with poor vegetative vigor, low crops and poor quality fruit are produced.

Peterson's first clue in diagnosing his vineyard's deficiency was the abnormal vegetative growth. "There was a lack of good vigor as we got into July, with smaller leaves and shorter internode spacing, as well as red dots and red bars on the mid-cane leaves," he said.

University of California has not yet published official guidelines for laboratory analysis of phosphorus deficiency on grapevines. Levels of phosphorus are known to drop throughout the bloom period, and to level off in midsummer. Different grape varieties in a given vineyard often show differences in phosphorus levels, and these levels may differ markedly from season to season.

Dr. Cook has found that, unlike most nutrient elements for grapevines, it is not possible to make an accurate determination of phosphorus deficiency from petiole analysis alone. Instead, the ration of leaf petiole phosphorus to leaf blade phosphorus is a more reliable means of identifying phosphorus deficiency. The following chart shows petiole and leaf blade analysis from trials done with Thompson Seedless conducted by Cook and Kishiba.

"A striking trend is seen here," said Cook. "When petiole phosphorus is in the high part of the range, it tends to be higher than that for corresponding leaf values. When the petiole level is low, the leaf value tends to show the higher content."

Cook recommends that blade values should be a minimum of 0.20% total phosphorus on a dry weight basis, and that petiole values should be at least that high.

"A one-to-one ratio of petioles to blades is ideal," says Cook.

	Percent phosphorus (dry weight)		Ratio
	Petiole	Blade	Petiole: Blade
	.49	.25	2.0
	.41	.24	1.7
adequate	.22	.22	1.0
levels	.22	.18	1.2
	.20	.15	1.3
	.19	.19	1.0
	.12	.19	.6
	.11	.17	.6
	.10	.18	.6
definitely	.07	.18	.4
deficient	.07	.15	.5

"A higher ratio, that is, blade values at or above 0.20% and petioles even higher, definitely indicates a sufficient level of phosphorus in the vine."

It should be stressed that these values are based on mid-summer levels of phosphorus. Thus a special sampling should be done where phosphorus deficiency is suspected. Petiole bloomtime values of phosphorus are a little higher than those in mid-summer, and ratios may vary. The blades and petioles are analyzed separately, and the ratio determined.

Recent work done by the university indicates that there is a varietal difference in uptake by the vine. Additional research is needed to determine the precise need by each individual grape variety for phosphorus. Pete Christensen, extension viticulturist at the UC Kearney Agricultural Center, has just released levels for varieties commonly grown in the Central Valley of California. Unfortunately, many important wine grape varie-

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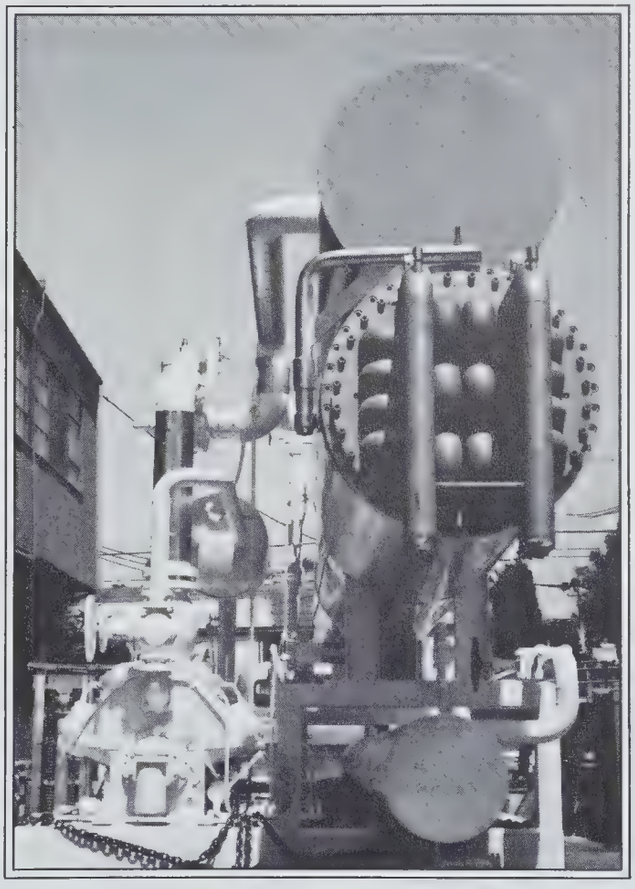

ties of the coastal growing regions were not included in this trial.

Grape Varieties Ranked by Petiole P Levels—Averages of Bloom and Veraison Samples UC Kearney Agricultural Center

High, above .40%: Calmeria—Chenin blanc—Emperor—Exotic—French Colombard—Ribier—Rubired—Queen—Sauvignon blanc—Zante Currant

Medium, .30—.40%: Barbera—Cardinal—Grenache—Italia—Muscat of Alexandria—Perlette—Petite Sirah—Ruby Seedless—Salvador—Semillon—Thompson Seedless—Zinfandel

Low, below .25—.30%: Carignane—Red Malaga—Ruby Cabernet

Possibly deficient, below .20%—None

Correcting Phosphorus Deficiency

A number of phosphorus fertilizers are available. Content of these fertilizers is expressed as the percentage content of phosphorus pentoxide, P_2O_5, which is not an actual component of many fertilizers. To avoid confusion from the use of this archaic system, and to be consistent with terminology used in soil, plant and pesticide analysis, University of California publications use the percentage of the element phosphorus, instead of the pentoxide percentage.

To convert fertilizer analysis to percent phosphorus, the following formulas are used:

$$\%P = \%P_2O_5 \times 0.43$$
$$\%P_2O_5 = \%P \times 2.29$$

Recommended amounts of fertilizer are given as the amount of actual phosphorus. For example, monoammonium phosphate contains 48% P_2O_5, but only 21% actual phosphorus. 100 lbs of this fertilizer must be used to supply 21 lbs of actual phosphorus.

The fertilizer formulation might be chosen based on a combination of things, including application method to be used, cost/pound of actual phosphorus, the fact that uptake of phosphorus is improved if ammonium nitrogen is included in the fertilizer formulation, and the water solubility of the phosphorus in the given formulation.

Rick Smith, field agronomist and owner of Formative Fertilizer, Inc., of Healdsburg, CA, has worked extensively with growers to correct nutrient deficiencies. "The primary reason we choose to use liquid ammonium polyphosphate (10-34-0), instead of phosphoric acid, is the ease of handling," says Smith. "The product was developed and manufactured to provide the liquid fertilizer industry and agriculture with a safe and easy-to-handle source of phosphorus. Unlike 10-34-0, phosphoric acid is a very corrosive and unsafe material to handle. The need for specialized equipment with phosphoric acid is a must."

Smith also stressed the importance of choosing a fertilizer with a very soluble form of phosphorus. "This is very important, since phosphorus must be in solution before absorption can take place." He also reports that he has helped correct phosphorus deficiencies at two other Sonoma County vineyards, using the same techniques that Peterson did.

The following chart shows several phosphorus fertilizer formulations sold commercially:

Formulation	N-P-K (P_2O_5)	actual P	%water-soluble P
Ammonium Polyphosphate*	10-34-0	3.6#/gal	100
Monoammonium phosphate	11-48-0	21%	89
Diammonium phosphate	11-48-0	20%	90
Single superphosphate	0-18-0	8%	40–50
Triple superphosphate	0-45-0	19%	60–70
Phosphoric acid	0-52-0	23%	100
Supersphosphoric acid	0-76-0	34%	100

*liquid formulation

Application of 100 to 125 pounds of actual phosphorus should give good correction. Peterson applied 40 gal of liquid 10-34-0/acre in his vineyard. This amount was the equivalent of only 60 pounds of actual phosphorus/acre, but also put 40 pounds of nitrogen on the vines/acre. When using a fertilizer with nitrogen and phosphorus in the formulation, the grower must be careful not to apply too much nitrogen, and Peterson saw this as the limiting factor with the ammonium polyphosphate formulation.

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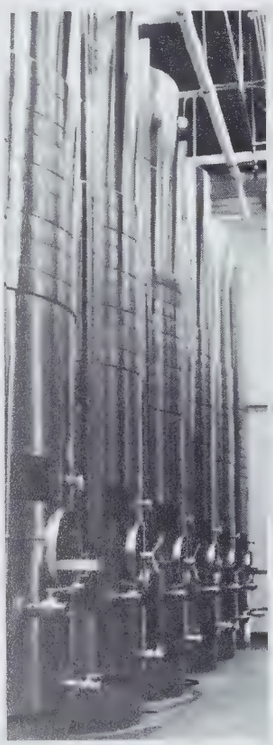

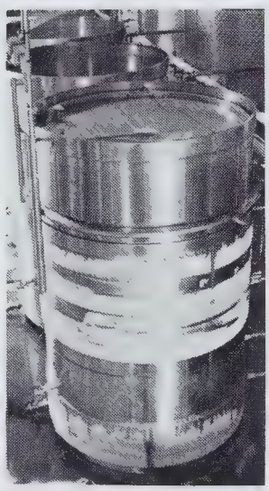

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Timing of application is very important for optimal uptake of phosphorus. If a vineyard is known to need phosphorus fertilizer, phosphorus should be placed into the root zone just before root growth activity begins in spring. Cool soil temperatures at this time of year slow fixation, giving a longer period for the plant to absorb the phosphorus. Earlier applications result in a large part of the phosphorus becoming bound in insoluble compounds.

When a deficiency has been discovered in mid-summer, immediate treatment of the vine with phosphorus brings about a very rapid improvement in the condition of the vines. Although cluster formation cannot be corrected once fruit set is complete, treated vines often show immediate improvement in vegetative growth, and can then produce normal clusters the next season.

It is very important that the phosphorus be moved rapidly into the root zone. This is best accomplished by drip irrigation. The University of California Cooperative Extension Bulletin #1893, 'Applying Nutrients and Other Chemicals to Trickle-Irrigated Crops', contains a good explanation of this procedure. It should be consulted before a choice of fertilizer is made.

Concentrated placement near the vine is also very important. By applying a large amount of phosphorus in a small volume of soil, a greater percentage of the phosphorus remains in an available form.

Peterson planned to apply a phosphate fertilizer to his vines again just before budbreak, 1986, through his drip irrigation system. "Phosphorus is easily bound up in my high-iron, acid soil, making it unavailable to the vines. I want to have adequate phosphorus in the root zone at the start of the growing season," he said.

Summary

As grape growers continue to plant vines on marginal soils, the incidence of phosphorus deficiency will increase in California. On those sites where soil phosphorus is very low in availability, due to acidic soil pH and the resulting insolubility of phosphorus, a deficiency can lead to reduced growth, poor fruit set and low yields. This may be the difference between profit and loss in some vineyards.

Correction of the deficiency is simple, and results are quick, once the problem has been diagnosed through the correlation of petiole and leaf blade analysis and visual symptoms.

Dr. Cook, who long ago predicted that phosphorus deficiency would be found in California, believes that grower awareness of the symptoms of the deficiency will result in future discoveries of deficient vineyards.

"Now that we have found vineyards with phosphorus deficiency symptoms in California, and have learned a little about them, I expect that growers with vines on acid soils will find deficiency in their own vineyards. We still need to do more work on the subject," said Cook.

Currently, the university is actively researching phosphorus deficiency in grapevines. It is expected that growers, armed with new information, will be better able to diagnose and correct this deficiency in the future.

* * *

The booklet 'Phosphorus for Agriculture' was recently published. There is a nominal charge of $.30. To order, write to The Potash and Phosphate Institute, 1649 Tullie Circle, N.E., Atlanta, CA 30329, phone (404) 634-4274.

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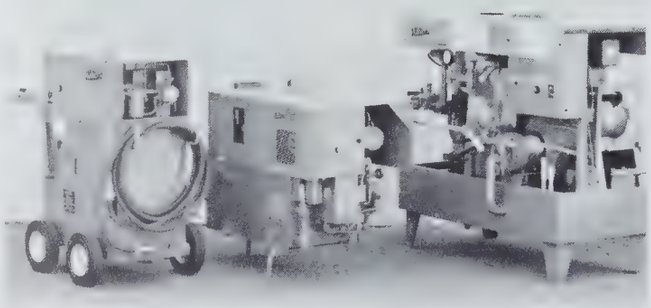

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"Essentially, winemaking is a recipied process in a large winery, where it is individualized from year to year in a small winery."
Ed Killian, Lambert Bridge

Among the roughly 1,200 wineries in operation in the United States, there is a great range in sizes. E. & J. Gallo, giant of the industry, has a total storage capacity of 330,000,000 gallons and is nearly four times larger than the corporation in second place, Seagram Wine Company. This statistic is dwarfed by the 1,000-fold difference between Gallo and the 100th largest winery, Jekel Vineyards, Greenfield, CA, which stores 330,000 gallons. For the winemakers interviewed below, a difference in size of as much as 4,000 exists between their former large winery and their present small one.

Richard Peterson of The Monterey Vineyard has recently moved from large to small yet again, going to Antinori, an Italian concern.

Ed Killian, winemaker at Lambert Bridge, Healdsburg, CA, producing 30,000 cases annually, came to his present winemaking position from Guild Wineries, Lodi, CA, with an annual production of 24,000,000 cases. Robert Brittan, St. Andrew's Winery, Napa, CA, at less than 10,000 cases, had worked at La Mont Winery, DiGiorgio, CA, making in excess of 14,000,000 cases. Michael Martella, Thomas Fogarty's winemaker, in charge of a 6,500-case production in Portola Valley, CA, also came from La Mont; California Growers, Yettem, CA; and Gibson Wine Co., Sanger, CA.

Lastly there is Richard Peterson, The Monterey Vineyard winemaker, who has done a double drop and about-face, starting at Gallo in Modesto, CA, in 1958, producing 40,000,000 cases at that time. He moved to Beaulieu in Rutherford, CA, (then producing 150,000 cases). After ten years he went on to The Monterey Vineyard in Gonzales, CA, producing 20,000 cases in 1973, building it up to 150,000 cases by 1985.

We fully expected to find a definite pattern after completing the interviews, and in accordance with all the other variables in winemaking, we did not. There are common threads among responses, but the greatest differences in changing from a large winery to a small one seems to come from the exact winemaking work done at a large facility and the interaction of the winemaker's individual personality and preferences for the various aspects of winemaking.

Reflecting on his 28 years in California winemaking, Peterson synthesized his opinions into the competence of the large winery. "Gallo," he says, "was technically excellent when I was there and they remain that way today. Coming from Gallo, a winemaker would be expected to be technically astute."

Peterson reflected on his first associations with André Tchelistcheff, who preceded Peterson at Beaulieu: "I was shocked at how well he did with bailing wire. Everything at Beaulieu was make-do in the late 1960s. When I went from technically competent Gallo to Beaulieu Vineyards, I shook my head. How on earth could anyone make decent wine by these methods? I was appalled by the lack of equipment and continually amazed at the beautiful wine that resulted from André's expertise."

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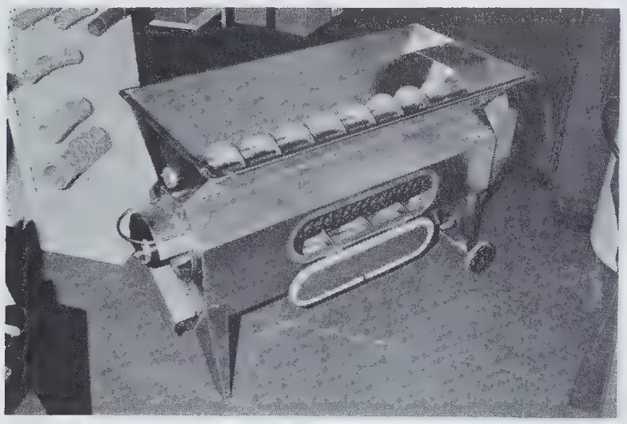

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Peterson believes there are similar analogies in 1986. Often, small wineries do not have equipment that they really need, but the winemaker's skill with bailing wire gets him through. He qualifies his remark: "Many small wineries do not make good wine in their first few years—they are always short of necessary equipment."

"At Lambert Bridge," says Killian, "I have responsibility for all of the day-to-day decisions, from when to pick the grapes to bottling the wine. Because of this, I have a great deal of pride in our product. On the other hand, I do miss the research and development projects conducted at a large winery.

"A large winery is a good place to start for a person just graduating from college because it can give a greater overall view of wine production. There are many opportunities to observe high-tech's role in the business, use sophisticated equipment, and participate in experimental procedures on the cutting edge of wine science. The experience helped me build a repertoire of analytical techniques."

Brittan comments similarly: "Winemaking has been called an art; I prefer to think of it as a craft. In any craft, a great deal of apprenticeship learning is required. When starting out, it is best to be in a facility where you have experienced people to watch and work with."

Martella says, "In a small winery, you get advice from winemaker friends whom you respect and who have positions in other small wineries. Winemakers are willing to share ideas and help each other out when one of them gets in a jam.

"When I went to La Mont in 1972, the winery was a revolving

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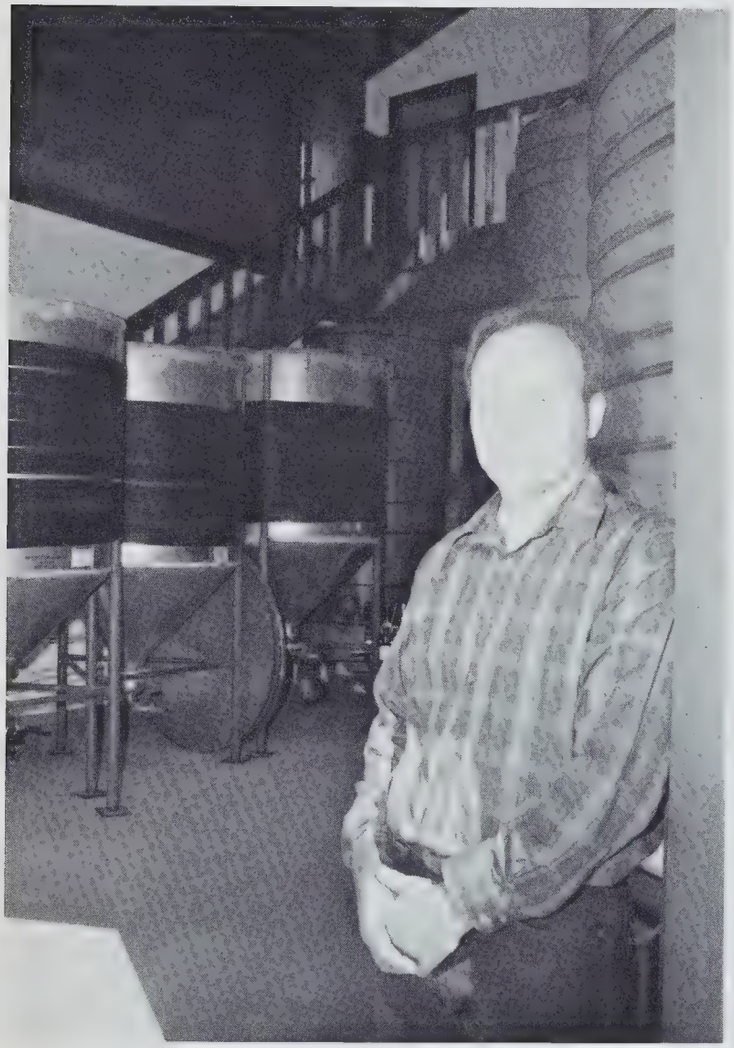
door for winemakers. I started out as an assistant winemaker and within six months, I was the winemaker in charge of 5,000,000 gallons of sweet wine. I got a lot of experience in a short period of time."

"A large winery gave me an increased awareness of technical winemaking," says Killian. "The technical support staff of chemists and micro-biologists helped train me to be aware of the varied problems of winemaking."

"The great advantage of starting in a large facility is a heightened awareness of control measures, record-keeping, wine tracking, and cost accounting," according to Brittan. "A large winery easily produces that record because all work is done via written work orders. Small wineries need to pay more attention to organization, tracking, and record-keeping even if only to be better prepared for a BATF audit."

"During the three years I was at La Mont," states Martella, "I spent much time in the lab tasting wines, making blends, and acting as a managerial supervisor. The winery was very large and the management team was equivalent to a small company."

Brittan adds, "Winemaking in the California Central Valley made me a more technical person than if I had begun my career in the Napa Valley, simply because the grapes are totally different. Central Valley fruit, with high pH and low acidity, required me to be more aware of sanitation, microbiology, and the day-to-day handling of wine. The experience intensely teaches the organic aspects of wine and the need to be a very good chemist. It also trained me to be very aware of winemaking options such as blending, fining, filtering, and analysis.



Mike Martella now works with 18,000 gallons oak cooperage and 8,000 gallons stainless steel at Thomas Fogarty Winery.

Rob Brittan of St. Andrews Winery currently has 12,600 gallons oak cooperage and 33,000 gallons stainless steel.

"When moving to a small winery, you tend to be more attuned to sanitation, chemistry, and the effects of wine handling if you've had large winery experience. On the premium Napa scale, you tend to be much more critical of grape quality because you want to avoid handling the wine as much as possible. When you have complete control over fruit quality, the technical support is not as important. I do all my own laboratory work and don't require the analytical staff needed at a large winery. But occasionally, I do miss the technical staff I worked with at La Mont. Sending out samples for analysis isn't the same as having your own staff to consult, where you can constantly check results and compare notes.

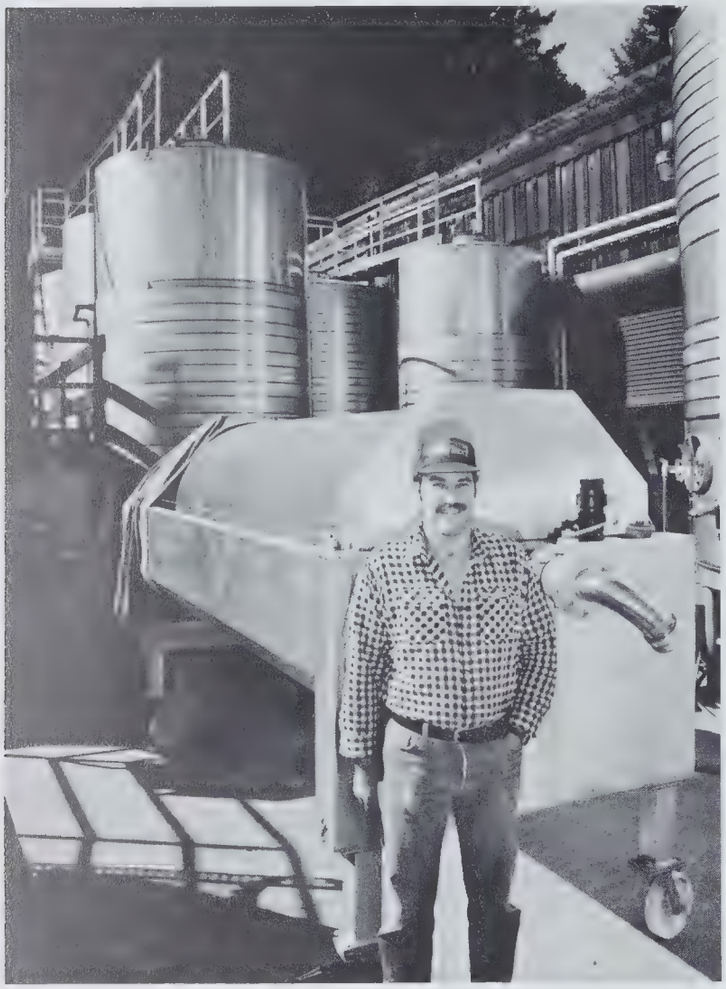
"Making the change to a small winery requires one to address several questions on a personal basis. Each individual must decide whether he is ready to accept the pressure of having total responsibility for a product. They must know that research interests have to take a back seat to the day-to-day operations of a facility. They have to ask themselves if their managerial skills are up to the organizational demands of the small winery. You must like physical labor, wearing many hats, and being a jack of all trades. In a large winery time tends to be organized for you.

"I've advised students with little mechanical ability to stay in the large winery situation where they can rely on a maintenance crew to repair plumbing and electrical problems," concluded Brittan.

"At Guild, I worked in quality control and R & D," says Killian. "I didn't get to do everything, but saw every phase of the winemaking process being accomplished by specialists. Guild had entire crews whose total responsibility was to keep the bottling line running. At Lambert Bridge, I must not only make

sure the wine is bottle-ready, but accomplish all of the logistics, too. I order corks, bottles, foils, labels, and glue, hire the crew, set up the modular bottling line and supervise the operation.

"This modular bottling line is slow, but there are many advantages. There is little to break down, almost no adjustment is needed, and it can be run by an unskilled crew. There's built-in quality control with many people handling each bottle in the process. This is a first line of defense. Since we label in a second process, each bottle is handled again. We usually spot leaky corks or chipped bottles. This is our second line of defense."



At Lambert Bridge, Ed Killian oversees 68,000 gallons oak cooperage and 69,000 gallons stainless steel.

Being at Guild's central bottling and blending facility gave Killian a large variety of problems to solve but he also saw how others would solve the same problems. "This can be a very positive start to a winemaking experience. I learned many quality control techniques at Guild that helped me focus on those that work best in a small winery.

"I performed every bench test for protein stability imaginable. Temperature tests were conducted in a variety of regimes: a) high temperature for short periods, b) low temperature for long periods, c) rapid cooling after heating, and d) slow cooling after heating. We also tried trichloroacetic acid precipitation, Bentotests (phosphomolybdic acid precipitation), and isoelectric focusing (protein separation by gel-electrophoresis)."

"I have a lot more work at Thomas Fogarty," says Martella. "However, it's more personalized. There is more control over production because we have much smaller lots. Our primary goal is quality first and quantity second."

Martella comments on lab analysis: "Lab work in a small winery is just basic analysis. We don't have the money for the equipment to do gas chromatographic analysis. Some winemakers are very good in chemistry. I'm not—I do things more by taste. My approach is to get the best grapes and then not manipulate the wine too much. In a large winery, the winemaker has little control over the grapes and wines are manipulated to the maximum."

"We don't have the time or money to do high-tech analysis at Lambert Bridge," says Killian, "but my experience taught me what types of assumptions I can make with respect to protein behavior. Here, I've adapted what I consider a rigorous test for protein stability that requires high temperature—about 50°C for 48 hours—followed by slow cooling to room temperature. Then I hold the bottle up to a high intensity lamp to detect any Tyndall Effect. The absence of haze after 24 hours is an acceptable margin.

"There is one mistake I might have made if it were not for my large winery experience with protein stability. Acid adjustment and protein stability are related. They should be coordinated and completed as early as possible in the winemaking scheme. If a wine is bentonite-fined for protein stability and later adjusted for acidity, the concurrent change in pH may result in an unstable wine. The fining process is pH-dependent because the ionic state of the proteins in solution is determined by pH. In other words, you learn to make all acid additions and pH adjustments before bentonite fining.

"In a large winery it is more important to have a totally stable wine than to worry about the stripping effect of the stabilization technique. In a small winery you can make a quality judgement about what risks you are willing to take with respect to tartrate and protein stability. We have to consider the audience to whom we are playing and the damage done by handling the wine one more time. We try to balance that against the risk of having an unstable product.

"Essentially, winemaking is a recipied process in a large winery, where it is individualized from year to year in a small winery.

"If we suspect bacterial spoilage in our small winery, we send a sample to an outside laboratory for analysis. The disadvantage is we must depend upon someone else's interpretation of the results. In a large winery we might take the sample to an in-house lab tech, get an opinion, and look at the slide ourselves."

"Eventually the job in a large winery becomes managerial," says Brittan. "At La Mont I had a staff of four winemakers, a quality control manager, a research chemist, and a cellar supervisor. We ran a 24-hour/day, 3-shift operation. On the other hand, as winemaker in a small winery, you must be constantly reminded that you are running a business. Attention must be paid to expenditures and cash flow as well as the wine's progress.

"The biggest difference between large and small wineries is the concept of quality. Large wineries talk about quality and make all of the physical moves necessary to achieve it; however, the winemaker in a small winery is more intimately involved in quality. The more intense concern for quality in a small winery has to become second nature. I moved to a small winery so I could have complete control. I want to produce wines of excellence, true to varietal character yet stylish, and that is only possible in a small winery."

"The hardest part of making the transition from big to little," says Killian, "is convincing a small winery owner that you can roll barrels, order supplies, and tend to the daily operation of a winery—that you are not a pipette prima donna.

"The easiest part of the change is giving up corporate politics—going through the chain of command. In a large winery a suggested decision is duplicated for eight pairs of eyes, each of which may provide an obstacle to hurdle. In a small winery the chain of command is one person—the owner."

High Yields = High Quality?

Joe Tarantino

Doug Meador had more in mind than demonstrating how quantity/quality ratios could improve when he established an experimental Gewurztraminer vineyard at his Ventana Vineyards in Soledad, CA. He wanted to destroy the widely-held assumption that 'the lower the yield, the higher the quality'.

"It is a marketing myth that has taken on the aspects of religion," says Meador. "I'm not saying the concept is wrong, but the spectrum in which it functions is in error. When I say you can improve quality at the same time as you increase yield, I mean higher total acid and lower pH at the given sugar than what would be done with the old system.

"I'm not making a flavor comment because the type of Gewurztraminer you wish to make is purely at the control of the grower. On the one hand we say, 'the lower the yield, the better the quality; get your yield down and you get more intense flavors.' But that is only relative to all the other aspects of farming.

"As Gewurztraminer berries turn a more cinnamon color, the intensity of flavor increases, which influences style and structure. If you try and pick them at 20 or 20.5° Brix to hold the acid and low pH, then you're shy on flavor. If you wait till the berries get more cinnamon-colored, till, say, 22 or 22.5° Brix, whatever your choice is, the acid is down, the pH is up, and you lose structure and ageing potential."

Meador had a successful 1983 harvest of 7.1 tons/acre (with sugar of 20.8° Brix, 3.32 pH and 0.92 TA), which was not bottled but sold. He decided to demonstrate the power of viticultural manipulation in 1984 and 1985.

"A case could be made that I raped the vines and stole some crop from the next year. But in 1984, we harvested 10.6 tons/acre more than two weeks earlier than our neighbors. I picked deliberately by color. I was after a different wine from the way that Gewurztraminer had previously been made in California.

"Gewurztraminers, in my opinion, were overly aggressive. The aroma would get a death grip on your nose, overpower the smell of all food on the table and even the Giorgio perfume on the lady next to you. I wanted a wine that smelled like Gewurztraminer, but controlled. I wanted balance, a little touch of sugar, (1.5% r.s. in the 1984), but also sufficient acid."

The total acidity was raised by about 0.1 with tartaric acid in 1984, just before fermentation. There were no other unusual steps in the vinification of the wine. 4,500 cases were bottled in June, 1985. Six weeks later it received a bronze medal at the California State Fair.

Meador sold some of the same juice to two home winemakers, both of whom also won awards for their versions. "Public response," says Meador, "was positive at tastings. People kept coming up and saying, 'I want the wine I can't pronounce'."

The 1984 Gewurztraminer was released at $5.99 suggested retail and has been sold mostly through the winery mailing list. Shipments have been made to selected markets in California, Arizona and New Mexico. Maitre d'Hôtel David Fink of The Pacific's Edge Restaurant, located at the Highland's Inn south of Carmel, CA, considers the wine reasonably priced, especially against the 1983 and 1984 Alsace wines. Fink parallels the structure to an Alsatian wine, describing it as lighter in fruit and body, with typical Gewurztraminer spice in the nose, but no bitterness. "It would go well with oysters," says Fink.

Meador's 1985 Gewurztraminer yielded 12 tons/acre and Meador says, "It is more powerful. I did it deliberately. I didn't make it heavy-handed, but more intense. I wanted to take that argument—the lower the yield, the better the quality or more intense the flavor at lower yields—away from people. I wanted to have the higher-yield wine more powerful. Had I done it the other way around, people would say, 'Oh, yeah, look what happened when he went up on yield—the intensity went down'. I wanted to show that when the yield went up, the power could go up, too."

Statistics on Meador's 1984 Gewurztraminer were 21.5° Brix, 3.35 pH and 0.86 TA. In 1985, he picked at 22.3° Brix, 3.31 pH and 0.85 TA. "Notice that between 1984 and 1985, we went up 0.8 on sugar, our pH went down .04, but our total acid went down only .01. I'm not saying we hit 100%," he cautions. "The numbers from these young vines should not be dwelled upon too much."

Meador did the switch to convince potential skeptics that bigger yields can be better. "I want to show the educated palates, the people in the industry, the educators. I want them to see those differences and understand it. They will take care of the rest of the world. Many consumers will not see the radical difference, but professionals will."

As for marketing the wines, Meador, who much prefers growing and selling grapes to the mundane responsibilities of owning a winery, says, "Marketing success will be linked to competitive awards, aggressive pricing and public acceptance at tastings. Competitive success will speak best for the wine. We do a newsletter and public tastings, and sell a lot of wine through our mailing list."

Meador's work may set the stage for a re-assessment of viticultural assumptions, winemaking styles and marketing tactics, all of which will be tested from the ground up. "Many, if not most, of the problems facing us as growers are a function of the California system of vineyard geometry. When that system evolved, different factors were in existence.

"Land and water were cheap and plentiful. Labor was cheap, plentiful and docile. I submit the idea that not one of those three things is true today. If the basic foundation of your system is crumbling, or has crumbled, that seems reason enough to re-evaluate the entire system."

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Close Vine Spacing: Pros & Cons, Part I

Mike Marcley

"I think we are in a revolution in the philosophy of viticulture right now," says Doug Meador, owner of Ventana Vineyards Winery in Soledad, CA. "I think we can increase our tonnage/acre and quality at the same time as well as reducing our chemical requirements.

"It's possible that our vineyards are designed wrong. I believe we have to start farming grapes according to the individual requirements of variety, clone and vineyard location (soil and climate). Twenty years from now if you see a vineyard in the coastal area of California that looks like the present ones—you will call it a dinosaur."

"We planted some Gewurztraminer in 1978 as a research experiment to 3x12 spacing. It is not the way to plant Gewurztraminer and I do not recommend this. It is better than the 'California' system but it has drawbacks. A better way is 3.5x6 and I do recommend that method." He added 4-foot crossarms in 1979 and trained them to bilateral, unidirectional cordons (20 spurs/cordon arm with 80-100 buds/vine) in 1980. "This results in an average of four feet between canopies, but the system's inherent problems with labor intensity, incompatability with mechanical harvesting and too much fruit per root system leave something to be desired. There are better ways.

"Yields were good (7.1, 10.5 and 12.0 tons/acre in the first three harvests (1983-85)," continued Meador, "but I don't think it's the best way to farm Gewurztraminer. My aim is to decrease the yield/vine and increase the vines and exposed leaf surface/acre by an amount suitable for our high region I, low region II climate and rock/gravel soil conditions to 90-feet in depth.

He's achieved this with Sauvignon blanc, White Riesling and Chardonnay, all of which are on 3.5x6 spacing. "In 1974 I planted two rows each of nine varieties on 3.5x12 to determine the effects of closer spacing," he recalls. "In 1978 I noticed the pH was lower in these rows than in fruit from vines planted 7x12. This encouraged me to explore further on close spacing for quality purposes. We started the theoretical work in 1976.

"The Gewurztraminer trial is based on dwarf apple research from East and Merton Malling Research Stations in England and Wenatchee Station in Washington state. One aim was to break the cyclical yield pattern of Gewurztraminer while maintaining or improving quality. Notice the yield sequence.

"Good apple growers were getting about 200 bushels/acre 30-40 years ago, but for the past 10-15 years they've been getting 2,000 bushels/acre. To achieve this they've had to change the geometry of their orchards to optimize use of their leaf exposure to maximize photosynthesis and fruit production. They also improved the quality of their apples. We went towards a 'mold and hold' philosophy on canopy control.

"I wanted to see if we could use this technology (developed for tree fruit) on grapevines to achieve the same results. In fact, the methods are transferring beautifully. With the 1984 vintage at more than double the normal 3-5 tons/acre, we received a bronze medal at the California State Fair judging for Gewurztraminer just a few weeks after bottling. In 1985 with an even higher yield (12 tons/acre), I was able to put even more power (breadth, depth, essense, extract) and intensity of flavor in the wine. The goal is to achieve 'power' without more alcohol."

Meador explains that he still has the flexibility of varying harvest dates to achieve different levels of power and intensity in his wine with the closer spacing and higher yields (he hasn't reached an overcropping situation yet).

"What I wanted to show was that I could get more intensity with higher tonnage if desired and that's what we did with Gewurztraminer. What you've got is a balancing act, you've got to decide what kind of wines are desired and produce the right grapes for them. You're balancing intensity with the wine's subtlety and structure."

His concept is farming for flavors and trying to get them into the grapes at lower sugar levels so they won't be overpowered by alcohol. It's worked with his White Riesling.

"I don't pick Riesling until I can taste an apricot flavor in the fruit," he explains. "The lowest sugar level that I've ever experienced this in fruit from vines spaced 7x12 was 20.5° Brix. In 1985 fruit on the young (three-year-old) close-spaced (3.5x6) vines had a strong apricot flavor at 19° Brix. If Riesling vines perform like the Gewurztraminer when they mature, we'll have achieved our goal."

Meador's older White Riesling vines on 7x12 spacing were planted on their own roots in 1973 and 1976. Newer vines on 3.5x6 spacing were planted in 1983 using cuttings from the adjacent older vines. "Wines made entirely from fruit of the older vines have won gold medals every year since 1977," states Meador. "We get apricot flavors from both spacings, but the flavors appear earlier and are more pronounced on the closer spacing. With the closer spacing, the yield/acre is higher, the pH lower, and we use less chemicals."

Close-spaced vines yielded 2.75 tons/acre (first crop) in 1985 while older vines on 7x12 yielded 7 tons/acre. Meador estimates yields of 12-14 tons/acre for the close-spaced vines but emphasizes that is only an estimate.

"I don't know exactly what this system will produce here. You have to remember this is all new. Also, this system may not have the same results in a different climate-soil complex with a different grower's procedures.

"Imagine a set of brackets, first around yields, then around flavor and other quality-determining parameters. At the low end you're under-cropped with low yields, excess vegetation and probably off, undesirable flavors. At the high end you're over-cropped with excess yields and diminished flavors.

"As we change the system of farming, the range of high and low yields and maximum and minimum flavors will also change. Application of these concepts is too new for anyone to be able to predict what the ranges will be in a given area with a given system."

Meador cautions that it is a mistake to try predicting mature vine performance (even that of his own vines in his own vineyard) based on results from 'these baby vines'. "It's like evaluating a human being's performance as an adult based on their conduct as a teenager.

"This close spacing system of 3.5x6 won't work for some other varieties, even in my own vineyard. For example, Chenin blanc is very vigorous here and should be planted at 5 or 6x9. I do have Sauvignon blanc on 3.5x6, but it's in very poor ground. As I said, we just don't know yet which is the best farming system for each variety in our own vineyard.

Doug Meador of Ventana Vineyards.

Gewurztraminer vineyard at Ventana Vineyards.

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"We do know that 3.5x6 spacing, in our gravelly soils, works for White Riesling and Chardonnay on their own roots with a vertical trellis and unilateral cordons (10-11 spur positions each) and even for Gewurztraminer (own roots) on four-foot cross arms and bilateral cordons.

Meador explains that with his farming system (spacing, trellising, pruning and training, water management, soil type and climate), he should even be able to regulate growth of vigorous varieties like Sauvignon blanc. "If it looks too close in this block when the vines are fully established, I'll hold off on irrigation and utilize other procedures to control vigor."

Sauvignon blanc cuttings were planted in 1981, 1982 and 1984 between rows of Gamay vines planted in 1973 and 1976 at 7x12 and budded to Sauvignon blanc in 1980. "For the past four years I've had to farm for the young vines (increased irrigation and fertilization) which has resulted in some stimulation of the older vines as well.

"This farming system won't work when Sauvignon blanc is on a rootstock such as AxR 1 or St. George in soil, instead of rocks—especially if it's fertile. In that situation I would try a closer-than-normal spacing, for example 5 or 6 x 9 or 10, on a vigor-reducing rootstock (SO4). The vines would be trained on a vertical trellis with cordons at about 26 inches and 14–15 node shoots growing straight up to about 80 inches.

"If I'd had enough money, I would have planted Sauvignon blanc on vigor-reducing rootstocks, but I had to graft over and interplant. I think 14 leaves/shoot is all that's necessary to ripen clusters. The traditional California farming and trellising system produces too many leaves and puts them in the wrong place, creating a tunnel of fruit.

"With the vertical trellis system, there's a cordon wire at 24–26 inches, another wire six inches higher [he takes a 6–8 bud kicker cane over this and ties it back to the cordon wire to improve central budburst of these canes], then there are three foliage wires about 12 - 14 inches apart." He uses unilateral cordons (10–11 double-spur positons each), and maybe kicker canes (totaling about 45 buds/vine) to fill 3.5-feet of trellis.

"We have a cool climate here (high region I) and historically don't get even set. I like to leave a few more buds than necessary and do some thinning after set. It's easier than trying to graft fruit back onto the vines.

"The vertical trellis gives a narrow canopy (about 10 inches wide) that provides good light and air penetration and exposes the fruit which is necessary for good flavor development in our climate."

Meador explains that the close spacing and vertical trellis system effect a more efficient distribution of vine energy, resulting in easier and more economic flavor management.

"Our soil is very cold until July, so vines on a normal 7-foot spacing struggle to fill the trellis. Budburst and bloom are very uneven because the vine's energy is spread too thinly. We regularly see bloom on primary clusters last 30–40 days beginning in June. This effect carries over to harvest, so fruit on these normally-spaced vines never ripens evenly. This means you have to go in and pick fruit from these vines 3–4 times in order to get the best flavors.

"Close spacing (3.5x6) causes smaller vines, but they have enough energy to fill 3.5 feet of trellis. Budburst is more even while bloom is earlier by 2–3 days and also more even (10–12 days long). When bloom is earlier and more uniform, fruit ripens earlier (mid-October for Chardonnay). Also, even ripening means we may only have to do one picking so the total operation is more economic than growing vines on a wider spacing."

Meador explains that close-spaced vines reach full production sooner (maybe year five) and produce more in every year than normally-spaced (7x11) vines in Soledad. "Take Chardonnay, for example. The first crop off my 3-year-old vines in 1985 was 1.62 tons/acre. They'll probably give four tons/acre in 1986 and eight in 1987.

"Chardonnay usually gives about 3–5 tons/acre on 7x12 spacing around Soledad. It usually takes about four years to get the first crop (1.5 tons/acre). You might get three tons/acre in the fifth year. Planting costs are about $5.00/vine ($2.85–grafted vine from nursery; $1.25–grape stake; and $0.50 for planting) or about $2,500/acre for 7x12 spacing (518 vines/acre).

"Considering income versus planting costs only (there is not enough cost difference between other operations–spraying, picking and pruning–to significantly affect the income benefits of closer spacing), there's a total of about $4,500/acre at the end of year five on 7x12. At $2,500/acre planting cost, there's an excess of $2,000.

"The 3.5x6 system produced $13,600 of income at the end of year five versus $10,500/acre planting cost (2,100 vines/acre, an excess of $3,600/acre). These numbers apply to a region I climate with vines on their own roots in gravel and in balance at

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2,100 vines/acre. I believe grape quality is determined by pounds of fruit per vine root system, and yield is determined by exposed leaf surface/unit area of ground."

The key is learning the correct farming system for each situation (variety, climate and soil type). For example, Meador relates that he couldn't solve the vegetative flavor problem in Sauvignon blanc with farming procedures alone. "The Wente clone that's widely planted around California does nicely in warmer areas, but doesn't do well in cool climates. We solved that problem with clonal selection.

"I found my 'Ventana clone' of Sauvignon blanc while working with clonal trials. The budwood came from a clone with such a magnificent flavor that I had to make wine from it."

He is showing that viticulture can be improved by using a farming system that is based on vine balance for the area and includes clone and rootstock selection, spacing, trellising, pruning and training, irrigation and fertilization control. "There's no free lunch. When you change one thing, it has multiple effects. It is a systems analysis, dynamic. It is not a static analysis, and does not succumb to that approach.

"Grapegrowing concepts aren't etched in stone. Practices that have proved successful in one area may not succeed in other areas. If you're going to grow grapes, you have to learn to understand 'vine'. When you go into a vineyard, those vines are talking to you. You must learn to listen to and understand them.

"But banks speak louder than vines, so I haven't been able to plant an entire vineyard with close spacing." (He doesn't have the financial support to invest in new and smaller equipment.)

Meador uses the same vineyard configuration found in the Sauterne district of France (12-foot inter-row spaces with separate groups of three vine rows 6 feet apart. "By leaving the original 12-foot spacing between each three-row grouping, I can run my spray rig down the 12-foot row. The booms straddle the rows; it's just a matter of adjusting the nozzles. I also drive the gondolas down the 12-foot rows at harvest. I can use standard California equipment and still get some benefits of a close-spaced vineyard."

Some fortunate people can plan their vineyards with the total farming concept in mind. They can choose clones, spacing, trellising, pruning and training systems and buy equipment necessary for the system. Pat and Joe Campbell, owners/managers of Elk Cove Vineyards, Gaston, Oregon, did this. They considered the local climatic support factor before setting up their vineyard.

"Close spacing seemed to make a lot of sense for this region," Joe related. He explained that Chuck Coury, a nearby grower who trained in Alsace, supplied cuttings for Elk Cove and helped convince him that close spacing was a good idea.

"Prior to planting the vineyard, my wife Pat and I visited northern France (a similar climatic region) and saw that they had close-spaced vineyards. There are a number of reasons for that, including soil, climate, vine vigor, crop size and quality, and harvest date—early October, usually before autumn rains—that seemedto apply to our situation. I decided to use the closest spacing (6x7) that would still allow room for a tractor."

Campbell has used a 46-inch wide Lamborghini crawler tractor and a Berthoud 160-gal pull-type sprayer. A new four-wheel 51.6-inch wide Ford Model 4610 tractor with 42.4 hp PTO has been purchased for the 1986 growing season.

"We wanted to be able to produce a reasonable crop every year without having to put too many clusters on each vine," says Campbell. "Our weather tends to be cool and wet during bloom so we have to leave extra buds at pruning to assure a reasonable crop. There's a tendency to leave too many buds on the widely-spaced (6x10) vines. In years with good weather at bloom (6 out of 10), you're overcropped and have to deal with this fruit or go in and do a lot of summer thinning.

"Narrow (6x7) planting has several advantages in this area: It promotes earlier and higher yields with better flavor than vineyards with wider spacing. Bloom is about a week earlier (June 15 was the earliest Chardonnay bloom) and only lasts about ten days, so our Chardonnay, Pinot Noir and Gewurztraminer can usually escape the rain which often comes in late June.

"We feel harvest is a little earlier on the closer spacing and

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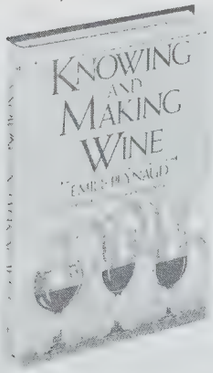

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that the berries have more flavor. Since we have no control plot here at our vineyard, it is just our observation.

"We only use earlier-ripening fruit to make our reserve Pinot Noir. We like to pick our Pinot noir by pH. The ideal is 3.15 with a 1.2 g/100mL TA and sugar at 22.5° Brix. We had these numbers in 1983 and 1985. We chaptalized with sugar in 1984 at the same pH and TA. The earlier ripening was probably due to better (more westerly) exposure of the vines (crop levels and other conditions were the same in both situations). This is always our best fruit. It's about 1.5° Brix riper when we pick (early October) and escapes autumn rains which usually begin in mid-late October. I wish all our grapes ripened this early!"

Campbell cane-prunes (24-28 buds/vine) each variety (Chardonnay, Pinot Noir, Gewurztraminer, and White Riesling) and at 1,054 vines/acre has enjoyed moderately high yields for these varieties (Table I). Vines are trained onto a 5-wire, vertical trellis. The bottom wire is 24–28 inches above ground and there are three more wires at 14- to 16-inch intervals above the first. Additional wires, parallel to the middle wires (4 and 5.5-feet above ground) help support the canopy.

The vines are hedged by hand once in late July or early August at 4- to 5-foot shoot growth (just before veraison) and again in late August or early September. Leaf removal is done in late September or early October from the cluster area on the east side of the vine.

The Campbells' spray schedule has proceeded thusly: spray #1 between May 25 and June 5 at 2–2.5 feet shoot growth of Bayleton at 3 oz/acre and boron at 1 lb/acre; spray #2 between June 20 and 25 at 1–5% bloom of micronized sulfur at 1.5 pints/acre, Ronilan at 1 lb/acre and Nufilm-17 at 1 pint/acre; spray #3 between July 10 and 15 of Bayleton at 3 oz/acre; and spray #4 between July 28 and August 5 of micronized sulfur at 1.5 pints/acre, Nufilm-17 at 1 pint/acre and Ronilan at 1 lb/acre. Ronilan is excluded from the last spray mix on Riesling vines where *Botrytis* is encouraged.

"We pick Riesling last (late October and early November) and it always seems to get some *Botrytis*," reports Campbell, "but our best wines are from years when the fruit had 20–30% *Botrytis*."

Close spacing has provided several benefits to the Campbells: vines usually come into production in the third year (instead of the fourth), yield about 20% more than vineyards with wider spacing, and produce flavorful fruit with good composition (Table I).

"We get a lot of aroma in our Chardonnay," states Pat Campbell, "but not always as much body (I'd like to see 22° Brix every year) as I'd prefer. Fruit reached this sugar level in 1978, '79, '83 and '85.

TABLE I
Yields and Harvest Composition of Grapes at Elk Cove Vineyards, Oregon

Year	Variety	Yield		°B	TA	pH
'79	Pinot noir	3.0		22.5	1.1	3.1-3.2
'80	"	2.0		20.0	1.2	"
'81	"	4.0		22.5	1.2	"
'82	"	4.5		22.5	1.2	"
'83	"	2.0		22.5	1.2	"
'84	"	6.0		18.0*		"
'85	"	4.0		17.0	1.2	"
'80	Gewurztraminer	2.0		23.0		
'81	"	2.0		23.0		
'82	"	4.0		23.0		
'83	"	2.0		23.0		
'84	"	4.0		18.0		
'85	"	2.0				
'79	Chardonnay	6.0		22.0		
'80	"	6.0				
'81	"	4.0	Botrytis			
'82	"	5.0				
'83	"	4.0	frost	22.0		
'84	"	6.0				
'85	"	4.0	hard prune (20 buds/ vine)	22.0		
'80	Riesling	3.0		20.0	1.2	
'81	"	2.8		20.0	1.2	
'82	"	5.0		20.0	1.2	
'83	"	5.0		20.0	1.2	
'84	"	5.0		18.0	1.4	
'85	"	5.0		20.0	1.2	

Pat Campbell drives tractor through Elk Cove's vineyards.

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"Higher yields are a major benefit of close spacing. This is particularly evident on our Chardonnay, which is the high-yielding heat-treated clone #108 from UC Davis, and is probably not suited to this area. We used clone #108 because it was available and produced consistent crops. We would never plant it again. We need a Chardonnay with smaller clusters, lower acids and earlier ripening similar to those found in Burgundy.

"For example, Dundee Hills Vineyard, which is on 8x12 spacing, leaves about 55-60 buds/vine but is constantly fighting to get a crop. Apparently other Oregon growers have noticed the benefits of a close-spaced, vertically-trellised vineyard for Oregon's cool climatic regions. Several of the larger wineries with vineyards originally planted on a wider spacing began interplanting and converting their trellises in 1981."

Elk Cove Vineyard is another example that close vine spacing (less than 6x10) and vertical trellising can work with some varieties in cool climatic regions. What will happen when these farming techniques are tried on other varieties in warmer regions with deeper and more fertile soils?

Near Bethel Heights Vineyard, Salem, OR, two new vineyards have recently been planted with vines three feet apart with 12-foot rows and four feet apart with seven-foot rows. Reasons given to justify the added expense and ongoing costs are earlier production, inducing more stress in the vineyards, which might result in earlier ripening, and larger production on mature vines.

"Early planting in Oregon was probably spaced too wide," according to Ted Casteel, Bethel Heights partner and vineyard manager. "Hyland Vineyard is 10x10, Knudsen-Erath was planted 9x9, and the Winquist and Seely plantings were 8x12. Our vineyard is 8x10. This led to difficulties in filling up the trellis with canes of 12 buds or less, and making efficient use of the whole vineyard space. A related problem has been too much vigor on mature vines.

"Whether the vigor problem is caused by the wide spacing, or just endemic to vineyards in Oregon planted on deep soils, is unclear. However, Jim Taylor of Five Mountains Vineyard has an older planting that is one of the most intensively planted in the state, 4x8. He has trouble getting more than 2+ tons/acre on Pinot noir, and is fighting the foliage all summer.

"He asked both Mark Kliewer (UC Davis Department of Viticulture and Enology) and Nelson Shaulis (Cornell University, retired) what he could do to improve his situation. They suggested that he move from a standard vertical trellis to some sort of hanging system with the fruit at the top of the canopy. Shaulis also suggested that he remove half his vines.

"The argument was that in situations where growth is encouraged by soil and water conditions, it is necessary to go for wide, open canopies (*e.g.*, Geneva Double Curtain) where fruitfulness is encouraged to give a good balance between fruit and canopy. Moreover, with the shoots growing downward, the vine is discouraged from growing long shoots. My experience is that in deeper soils, more plants will only give you more foliage to deal with.

"When Dominique Lafon was asked why the French plant so intensively, he responded that their soil is so poor and depleted of resources that they need 4,000 plants/acre to get a full crop. That is certainly not our situation here on most sites. In the 1970s, when most of the vineyards were being planted, everyone thought that deep Jory (volcanic) loam was the only way to go.

"Our vineyard is planted on Nekia, which is only half as deep and has only ⅓ of the water-holding capacity of Jory, and we don't have a vigor problem. I don't feel that very intensive planting would have given us any major benefit, although I do wish we had gone 6x10 so that a 12-bud cane could be used, and still adequately fill the trellis.

"A lot of interplanting was done in the early 1980s to help yields and control vigor. Erath did it, and we experimented with it. It hasn't worked very well. It takes about five years to get the interplants up the stake and shading has really retarded the growth of interplants.

"For me, intensive planting is still an open question."

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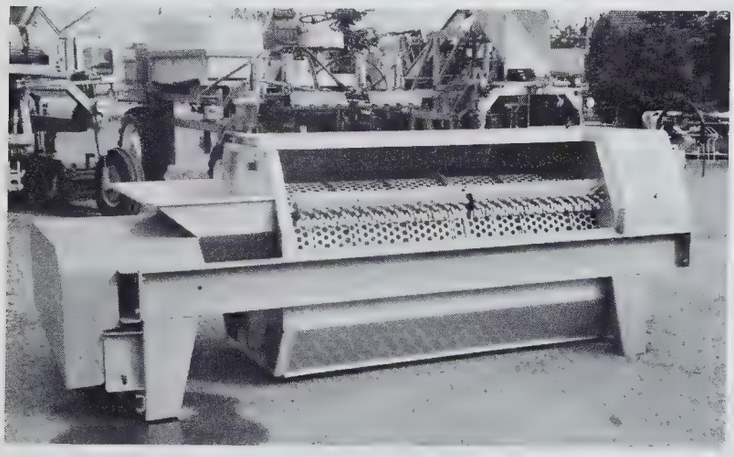

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David Spaulding, winemaker for Stonegate Winery, Calistoga, CA, says, "We use our pressure cleaner for almost all winery equipment cleaning needs, including cleaning the press, stemmer/crusher, lees filter, and barrels. We even use it for general winery cleaning—floors, walls, plumbing, etc." Spaulding's cleaner has a maximum pressure of 500 psi; steam is not used.

Bill Miller, production manager of The Merry Vintners, Santa Rosa, CA, uses hot water pressure of about 1,000 psi for winery equipment cleaning. He says, "A hot-water pressure cleaner is useful for washing barrels because the hot water and high pressure is great for removing tartrates. It's also good for removing mold growth from winery floors. On the press, we use high pressure only for final cleaning of press screens; high pressure blows pomace all over clean surfaces."

David C. Whitehouse, Jr., winemaker at Trefethen Vineyards, Napa, CA, comments, "We use a high-pressure cold-water washer for cleaning the cloths on a lees filter to force solids out from inside the cloth."

These statements illustrate one of the most important choices potential cleaner purchasers must make. How much pressure do they need? Demonstration of various units can help them decide.

One manufacturer recently switched from a plunger pump to a piston pump, increasing pressure from 500 psi to 750 psi. Increased pressure capabilities enable more general cleaning, including tartrate removal in tanks. Another manufacturer offers pressure capabilities up to 2600 psi.

Gary Hada, winemaker for Summerhill Vineyards, Gilroy, CA, cleans barrels using low (50 psi) pressure warm (180°F) water with soda ash. He also uses a combination of high (650 psi) pressure hot (200°F) water and steam for cleaning the press: "We use steam for stubborn spots, never chemicals." For removal of tartrates from tanks, Hada says, "We use a steamer cleaner on steam setting (325°F) to heat water."

Another choice illustrated above is whether to use steam or water, and, if water is used, whether it should be hot or cold. Steam is generally used for grease and oil removal. Hot water is used for sanitation, and cold water is used for light dirt and mud. If you need all these applications, then perhaps a combination unit, including hot and cold water and steam, is the choice for you. Some units have these adjustments on the lance. Also, some units have no pressure gauge or regulator, only a temperature adjustment.

Then there is the question of what fuel to use. Choices are domestic fuel oil, jet fuel, kerosene, diesel fuel, or LPG. Diesel, for instance, may be recommended for its added heating capacity, but LPG's cleanliness may be more desirable. Also available are gasoline- and diesel-driven units for field application.

Jeff Baker, winemaker for Carmenet Vineyards, Sonoma, CA, has yet another use for his steam cleaner: "We use it to heat glycol to warm tanks. Our steam cleaner is plumbed so that I

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The varied uses illustrated above bring up the important question of what accessories you may want on your cleaner. Available are foamers with adjustable foam injectors on the lance, rotary brushes for bottling room tile walls, and a high-pressure floor cleaner that works without splashing.

Other choices that the prospective cleaner buyer should keep in mind involve belt-driven vs. direct-drive pumps; whether the pump is self-priming; pump durability; and availability of local parts and service.

Quality pressure washers and steam cleaners are essential to winemakers. The ability to maintain clean equipment and working areas in all phases of production is necessary to prevent possible bacterial spoilage of wine.

* * *

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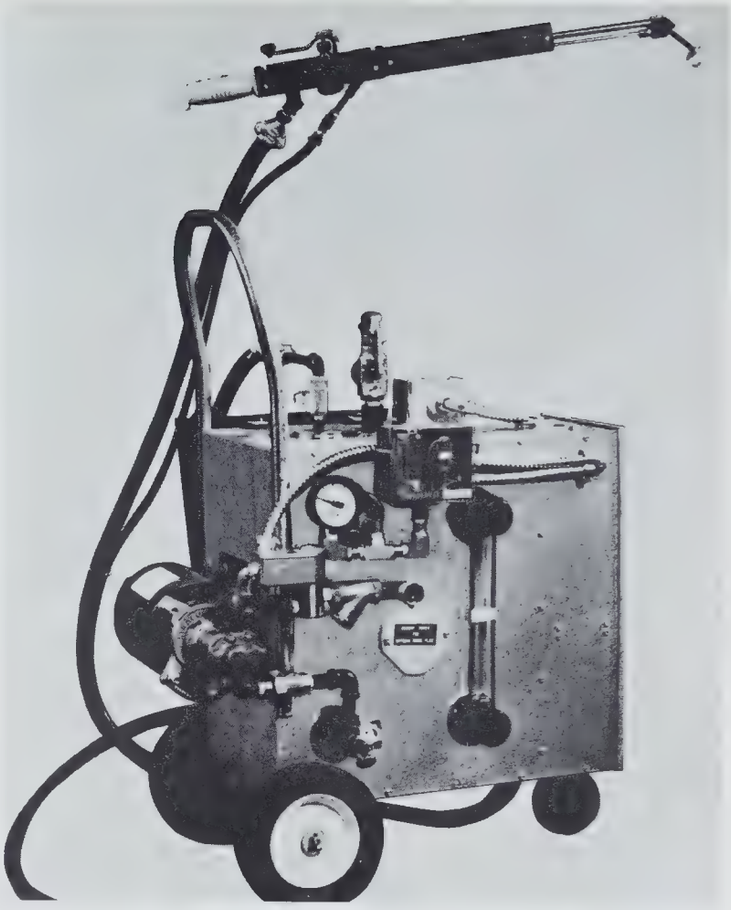
Electric 'Dry-Steam' Portable Plug-In Cleaners include many features. There is no open flame, making it safe for indoor use, and thereby possibly reducing insurance rates. 'Dry-Steam' eliminates flooding on floors and equipment; 6 gallons of water/hour can produce 97% vapor-quality steam. There are no moving parts or pressure pumps to foul or adjust. The desired cleaning chemical is siphoned through the Steam Gun and atomized by the 85 psi steam pressure for pin-point cleaning. The operator can cut off the chemicals at the gun and use clean steam for washing or rinsing. The unit is intended for filters and cappers as well as general winery maintenance.



Electro-Steam portable steam cleaner Model 10-C.

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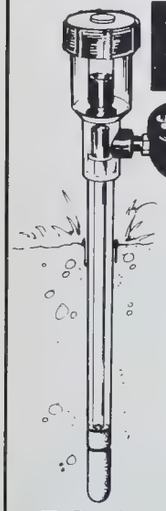

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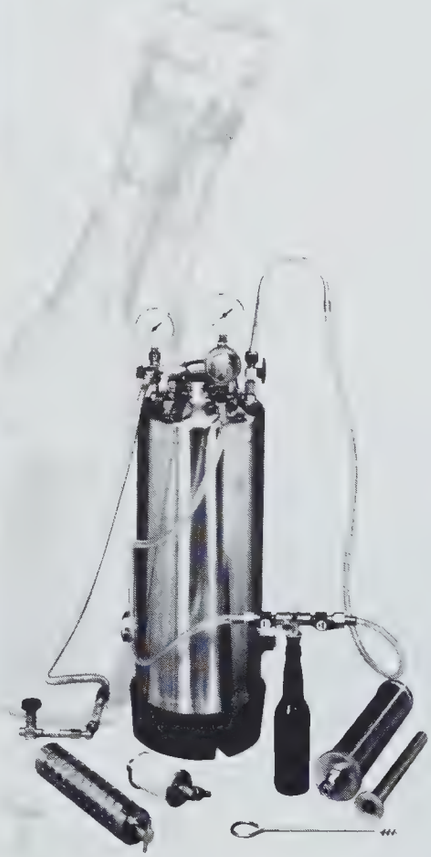

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The Electro-Steam Generator/Cleaner requires 220 or 440 volts and has a plug-in cord; all controls and accessories are included. A garden hose is required for potable water feed. Steam is developed and ready for use within 10 minutes of start-up.

These portable cleaners are offered in sizes of 10 KW, 30 KW, and larger. All of our 100% electric steam products are built in accordance with ASME Miniature Code, National Board of PVI Shop Inspection, UL, CSA, and OSHA requirements.

"We have had our Electro-Steam model #200 plus for three years now, and it works fine for our application. That includes sterilization of the bottling line (filter, filler, etc.) and tractor cleaning. This model is suited to steam use." —Steve Reeder, Winemaker & General Manager, McGregor Vineyard, NY

Inquiries to: Electro-Steam Generator Corporation, 1000 Bernard Street, Alexandria, VA 22314, phone: (703) 549-0664

SEE OUR AD PAGE 81

The Hotsy Corporation
Englewood, CO

Hotsy offers over 50 models, providing from 2–10 gal/minute of water discharge at pressure adjustable to 3,000 psi and at water temperature from ambient to 210°F with steam as an option. Water heating is accomplished with fuel oil, propane or natural gas. For portable units used indoors, propane is popular when contamination from fuel oil soot must be avoided on product or its handling machinery.

Coil design and proper burner sizing enable the mainline Hotsy machines to deliver high pressure water at actual temperature in excess of 200°F, entirely negating the need for steam in almost all cleaning applications. This avoids energy waste and service problems of the conventional or combination steam cleaner.

Hotsy's features include replaceable vertical coils, rust-proof fuel and float tanks, and easy accessibility to operating components. Hotsy controls design and manufacture of over 80% of its unit components. Hotsys are marketed through specialized factory-direct authorized sales and service centers, providing user instruction, machine installation, warranty and service availability.

"Our maintenance department uses the Hotsy regularly, before and after repair jobs. There seems to be no end to the time-saving, money-saving applications for the Hotsy pressure cleaner; we even used it to clean the exterior walls of our winery (a significant savings over scrubbing with brushes or repainting)." —Dave Munksgaard, Assistant Winemaker, Chateau St. Jean, CA

Hotsy carries accessories for many applications, including automatic timers, foamers, rotary brushes, down-stream chemi-

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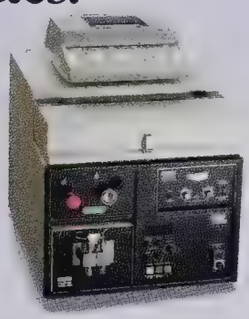

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cal injectors, wand extensions, special nozzles, and safety controls. In addition, Hotsy manufactures its own line of cleaning detergents and chemicals for all applications to achieve maximum performance while prolonging the life of the equipment. All formulas are biologically degradable and USDA-approved.

Inquiries to: The Hotsy Corporation, 21 Inverness Way East, Englewood, CO 80112, phone: toll-free (800) 525-1976; or Hotsy Pacific, 4543 Enterprise St., Fremont, CA 94538, phone: (415) 657-4985

SEE OUR AD PAGE 41

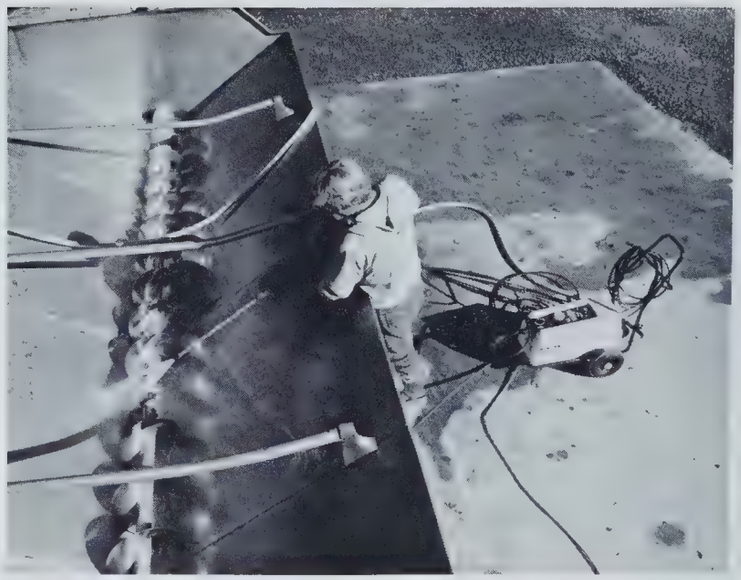
K.E.W. Cleaning Systems
Petaluma, CA

K.E.W. Industries manufactures portable and stationary high-pressure cleaning systems providing pressures up to 2,610 psi. Accessories are also available to handle specific cleaning needs in various applications.

Portable high-pressure cleaners are available in cold water, warm water, hot water and steam models. Combination models can provide cold/hot water or steam by turning a dial to the desired temperature up to 302°F. A lighted diode scale on the control panel indicates the actual temperature of the high-pressure water or steam.

The portable units are powered by either direct-drive electric motors, gasoline engines, or diesel engines. The hot water/steam models can use six different fuels: Either #1 or #2 diesel fuel, #1 or #2 domestic fuel oil, kerosene, or jet fuel. Water pressures and chemical/soap injection can be varied at the rotatable lance. The water capacity or flow is also adjustable. All hose connections utilize quick-connect rotating couplers.

Stationary high-pressure cleaning systems are available in either single pump wall-mounted models or multi-pump modular models for plumbed-in applications. Pressure ranges are up to 2,320 psi. These systems are intended for applications requiring take-off points at various locations throughout a winery.



KEW Model 1002K cold-water high-pressure cleaner at Grand Cru Winery, CA.

Most of the high-pressure cleaning systems utilize a unique and proven direct-drive axial piston pump which is designed to enable it to run without water or pump damage. The pump is also self-priming and can lift water up to an 18-foot head.

K.E.W. also manufactures many accessories, including chemical/soap injectors, foam injectors and foam lances, water sand-

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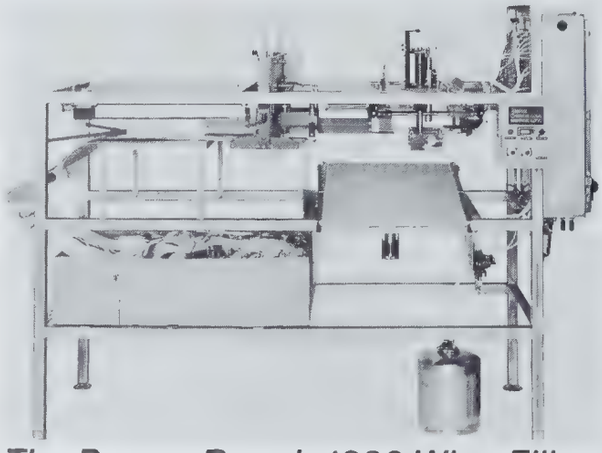

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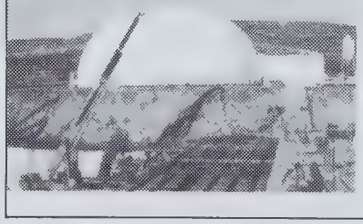

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blasting lances, short and long rotary brushes, washing brushes, floor cleaners, drain cleaning nozzles, super-short to extra-long lances, tank cleaners, and extension hoses. A K.E.W. dealer will give a no-obligation demonstration of their pressure cleaning systems and accessories.

"We've had our K.E.W. for nearly a year now. It is compact and has a good pump and design where the chemicals are injected downstream from the pump. These K.E.W.s are great!" —Dennis Martin, Assistant Winemaker, Fetzer Vineyards, CA

Inquiries in California to Scott Laboratories, PO Box 9167, San Rafael, CA 94912, phone: (415) 457-8460; Inquiries outside California to: K.E.W. Industries, Inc., 1372-E North McDowell Bl., Petaluma, CA 94952, phone: (707) 762-9600

SEE OUR ADS PAGES 22 + 38

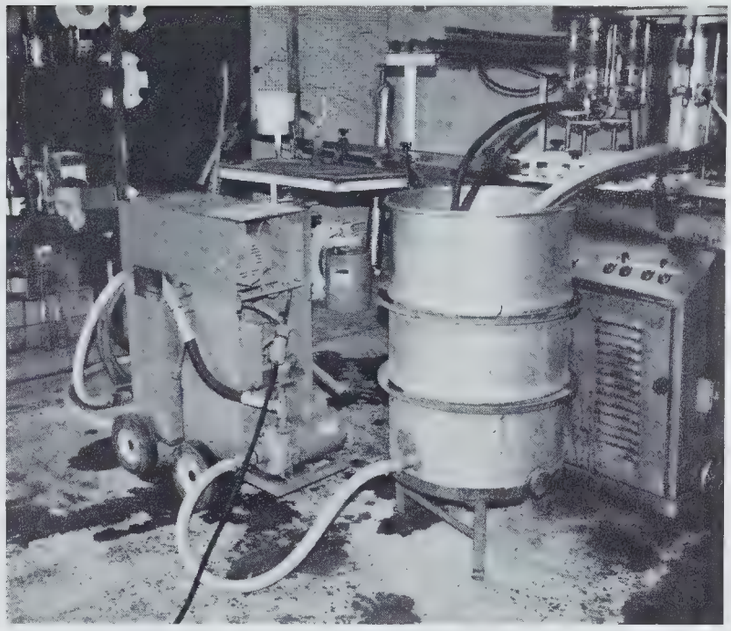
Walters Manufacturing Company
Watsonville, CA

In addition to the Model 85, designed for smaller wineries, Walters makes a line of combination pressure washers/steam cleaners that includes 24 standard models with over 40 customizing options. These include automatic cool-down, circulating pumps, gasoline engine drive, and 3-phase power.

Cleaning capacities range from 80–420 gph, with working pressure from 100–1,000 psi, and temperatures from cold (50°F) to 325°F (steam cleaning).

Walters cleaners can burn natural gas, LPG fuels, or #2 Diesel. Portable models are available with electric motor or gasoline engine drive. Walters will modify cleaners to meet special winery needs.

"In 1984, I chose the Walters Model 104 because of its rugged construction and ability to provide steam and flow-through water heating as well as pressure washing. This washer has become a mainstay of our wine-processing operation, and I have been completely satisfied with its performance." —Jeffrey C. Baker, Winemaker, Carmenet Vineyard & Winery, CA



Walters Model 85 combination pressure washer/steam cleaner.

Inquiries to: Walters Manufacturing Company, 297 Anna St., Watsonville, CA 95076, phone: (408) 724-1377

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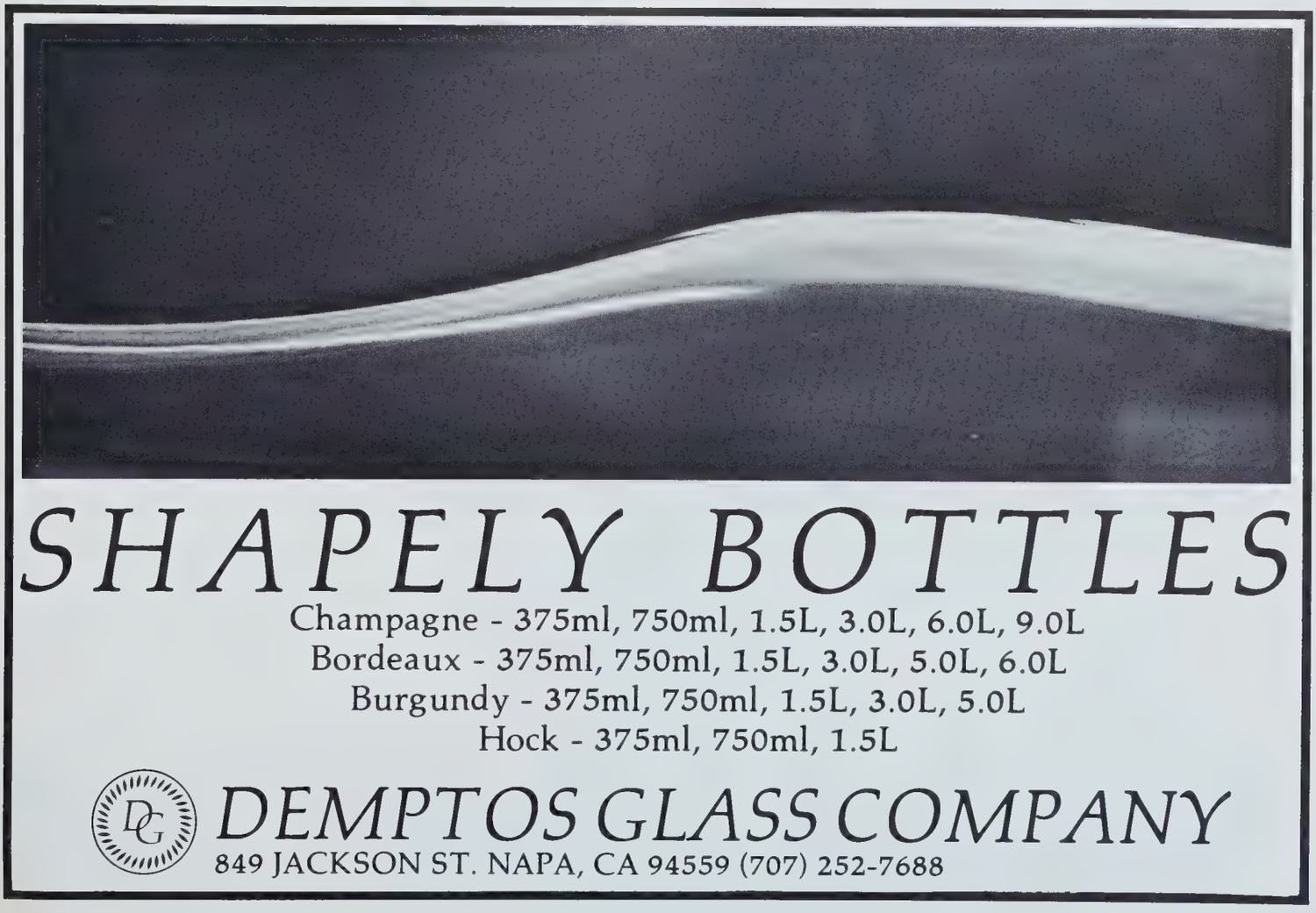
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Davison Protein Removal System Development

Dr. Yves O. Parent & Dr. William A. Welsh

An approach to protein removal from wine in a continuous (flow-through) unit operation (*PW*, May/June 1985) was introduced by the Davison Chemical Division of W.R. Grace & Co., Baltimore, MD. We concluded, at that time, that the Grace adsorbent was capable of heat-stabilizing wine. However, it was clear that the system required an in-line continuous monitoring device that would indicate when the discharge wine was no longer heat-stable. It was our objective to develop this so-called 'quick-test' in time for the semi-commercial-size plant trials scheduled for late spring, 1985, at three wineries.

A scaled-up version of the original Davison system, used during the November 1984 lab-scale trials (scale: 5 gallons processed), was set up and operated in three participating wineries during May 1985. The goal was to heat-stabilize larger volumes of wine (scale: 500+ gallons processed) at flow rates of approximately 150 gal/hour that would test hardware components and concepts in anticipation of further scale-up to commercial-size equipment for the 1986 season.

The system operated well within the predicted ranges of performance in terms of heat-stabilizing processed wines. Performance data had been predicted from lab-scale tests prior to actual pilot scale runs. Data for chemical/physical properties of the wines processed are presented in Table 1 and sensory characteristics data on bottle-aged samples are given in Table 2. In all cases, no significant differences are to be found between Davison System treated and bentonited wines. Physical and chemical analyses were conducted by Vinquiry, Healdsburg, CA, and sensory evaluations were conducted at UC Davis.

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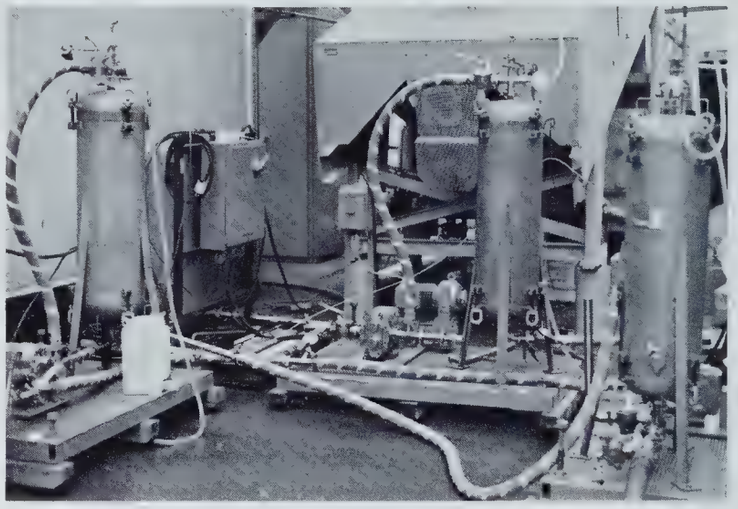


Experimental pilot-scale continuous heat-stabilizing system used during the spring 1985 tests. Individual skid-mounted pressure vessel and feed pump units can be operated in series or in parallel.

To evaluate the effects of bottle age on the sensory character of the May 1985 Grace-processed wines, the sample sets were submitted to UC Davis for evaluation. As before, the wines were subjected to duo-trio difference testing comparing each combination: Grace process vs. control (no treatment), bentonite vs. control, and Grace vs. bentonite. The tastings were conducted after seven months of bottle age. In addition, a duplicate set of samples was subjected to accelerated ageing (35°C for 35 days) to simulate approximately one additional year of age. No changes were found in the stability status of the wines after seven months of bottle ageing.

System Revisions

Some practical problems with pilot plant operation were encountered during the spring 1985 trials. All were related to the means by which the wine is contacted with the solid adsorbent in order to remove the heat labile protein and heat-stabilize the wine product.

The process, at that time, involved pumping the wine to a pressure vessel containing a packed bed of small solid adsorbent particles and the required hardware to provide proper and adequate flow distribution. Pressures of 100–120 psig are needed in order to have the wine flow through the system. Fermentation solids, CO_2, and other 'contaminants' in the wine could result in fouling of flow distributors and of the packed bed itself. Clarity of the wine being fed to the system and equipment requirements were judged too restrictive to make such a system practically and economically viable.

The revised design can process freshly-fermented wines containing solids and CO_2 at operating pressures of 5 psig. System component design is thus relieved of the constraints of pressure, and typical centrifugal pumping can be used.

Performance of the revised system concepts in hardware and operation were tested at an eastern U.S. winery in October, 1985. Freshly-fermented wines with 1% solids and visible amounts of CO_2 were heat-stabilized without any flow distribution problems or system pressures in excess of 2–3 psig. No official sensory evaluations were carried out on these samples other than on-site routine tasting by winery personnel, who detected no differences.

Hardware modifications have been implemented into a pilot-scale system, which were tested on 1,000–5,000 gal-lots of wine at a California winery in spring 1986.

TABLE 1

Sample	Alcohol [vol.]	Titratable Acidity [g/100ml]	pH	Free/Total SO2, Ripper [mg/L]	Reducing Sugar [g/100ml]	Total (1) Protein [mg/L]	Total Phenols GAE [mg/L]	Sodium [mg/L]	Potassium [mg/L]	Calcium [mg/L]	420/520	Heat (2) Stability Yes/No
CU 2	12.80	0.548	3.31	20/70	0.11	22	225	8	520	96	.076/.025	N
CX 2	12.80	0.540	3.26	21/72	0.10	16	226	12	500	99	.074/.017	Y
CY 2	12.85	0.555	3.27	22/68	0.11	13	223	8	520	99	.072/.022	Y
HU 12	11.50	0.563	3.47	40/170	0.17	18	359	27	860	81	.079/.020	Y
HX 12	11.30	0.563	3.43	36/159	0.16	14	322	30	840	83	.070/.021	Y
HY 12	11.10	0.548	3.46	30/158	0.17	11	335	28	850	77	.080/.021	Y
IU 12	13.00	0.570	3.49	31/113	0.15	34	285	40	850	72	.079/.018	N
IX 12	13.00	0.570	3.48	34/112	0.14	15	270	42	850	68	.068/.017	Y
IY 12	13.00	0.570	3.48	27/106	0.15	11	272	41	840	67	.082/.022	±Y

Winery: C, H, I
Treatment: U Unfined; X Bentonited; Y Grace System Fined
Variety: 2 Chenin Blanc; 12 White Table Wine

(1) Bio-Rad Assay Method
(2) Sample heated for 24 hours at 60°C; refrigerated, -4°C for approximately 1 hour or until sample reaches room temperature. Evaluated with high intensity light; heated sample vs. control (unheated; membrane filtered)

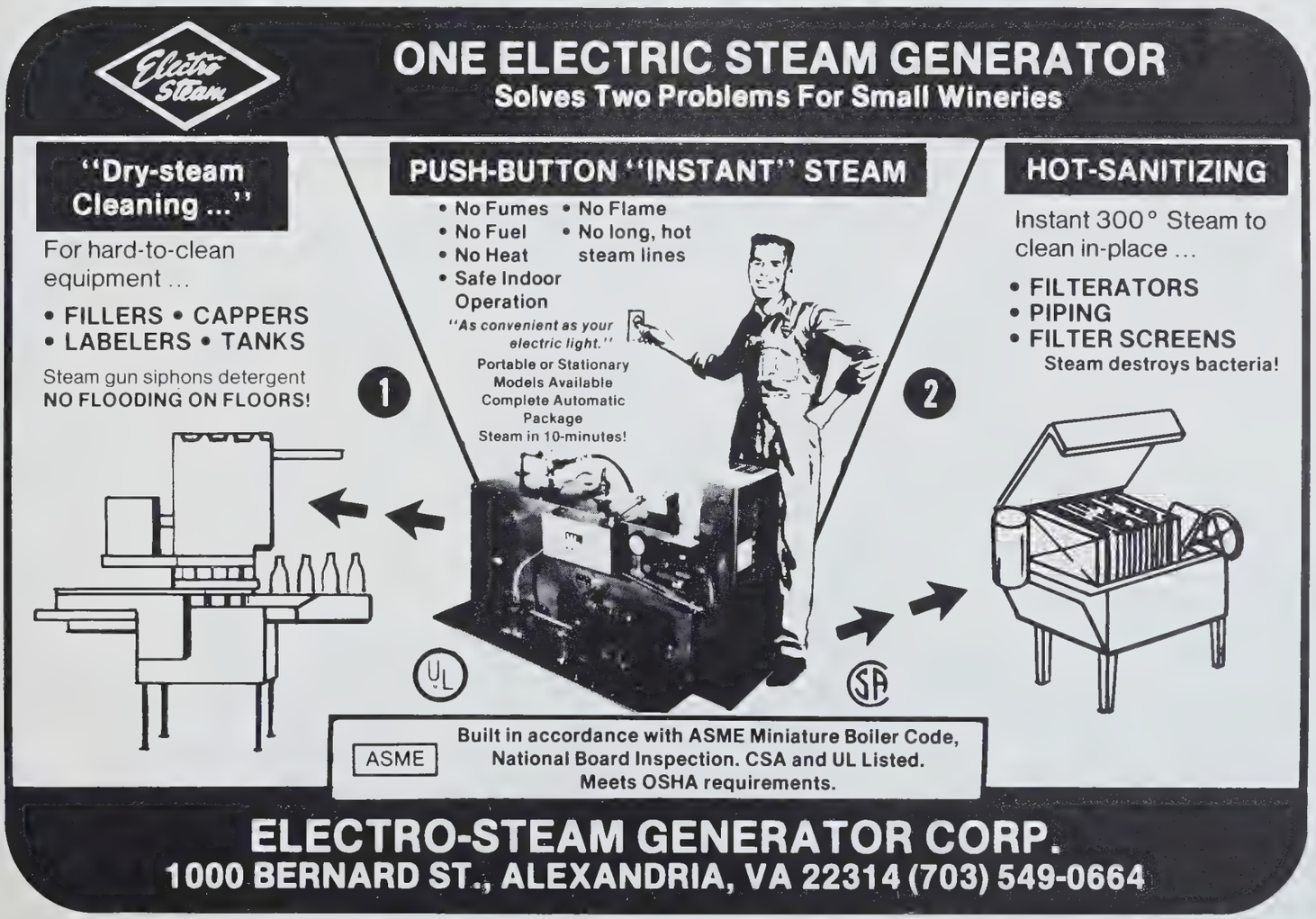
Wine Heat Instability Index Monitoring

A Davison optical density measurement technique has been developed which allows for rapid testing for heat stability. The time required for a reliable reading is one–two minutes. Individual samples of wine exhibiting various levels of fining or heat-induced haziness can be correlated to an Instability Index equivalent as determined by this test.

The Davison procedure is automated, and the custom-built apparatus can be operated continuously or sequentially at regular or variable time intervals while the output reading is recorded electronically. The signal can also be used for control of the Davison Heat-Stabilizing System. Once the correlation between degree of fining and Instability Index has been established, the user can adjust the operating parameters of the Davison Heat-Stabilizing System to yield a treated wine product fined to the level or extent desired.

Table 3 presents data obtained for the three wines processed during the spring 1985 trials. Data for three techniques attempting to correlate heat-instability haziness measurements to some numerical scale are shown.

A Bio-Rad Protein Assay enables one to quantify the concen-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tration of protein in an unknown sample in terms of the concentration of a known protein in a standard reference solution. The procedure usually shows total rather than specific protein content. Furthermore, a background value of 50% of that of the unfined wine is typical for wine samples that have been bentonited to stability. The short range in numerical values obtained also limits the applicability of the test to this type of monitoring.

The set of data under the heading HAZE represents Nephelo Turbidity Units (NTU) obtained with wine samples which have been exposed to a temperature of 97°C for 7 minutes followed by cooling at 4°C for 24 hours. Such a temperature cycling normally induces a haze formation observable to the eye or by some electronic optical technique. The range in numerical value obtained does vary as the bentonite loading requirements to fine such a wine sample varies. In any case, the range in values is not very broad and experimental error can be significant. Furthermore, this technique requires time even if the cooling cycle is reduced to a few minutes and the process is not so easily automated.

Data for the Davison technique are presented under the heading 'Instability Index' and are expressed in NTU. Here, the range in values is much broader than for the other techniques and can be obtained very rapidly (1–2 minutes). For example,

TABLE 2
Results of Duo-Trio Difference tests comparing Grace treated, Bentonite treated and Untreated wine samples.

Sensory Test Results, University of California, Davis
Professor Ann Noble

Winery Code	Variety	Sample Treatment	Bottle Aged Wines (1) Significant (2)	Aged [accelerated] Wines Significance
C	Chenin Blanc	a	0.252	0.132
		b	0.252	0.058 (3)
		c	0.412	0.748
H	White Table Wine	a	0.748	0.252
		b	0.588	0.412
		c	0.868	0.588
I	White Table Wine	a	0.588	n/a
		b	0.252	n/a
		c	0.412	0.415 (4)

Sample Set
(a) Control vs. Grace
(b) Control vs. Bentonite
(c) Grace vs. Bentonite

(1) For both sets: N=20, 10 judges, 2 replications
(2) All tests showed no significant differences. The values shown indicate the fraction of time that these results could have occurred by chance alone.
(3) This test showed an "almost significant" difference. A significant difference is defined as one that would have occurred less than 5% of the time by chance alone.
(4) Due to a shortage of the control wine from winery I, no comparisons between either treatment and control were possible.

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TABLE 3
HEAT STABILITY DATA
Spring 1985, Pilot Scale Trials

Sample	Treatment	Volume Processed [gallons]	Flow Rates [GPH]	Bio-Rad Protein [mg/L]	HAZE (1) [NTU]	Instability (2) Index [NTU]
C-2	NONE			22	2.00	30
	Grace System	600	140	16	0.40	0.6
	Bentonite (4lbs./1000gal.)			13	0.70	0.4
H-12	NONE			18	1.00	5.5
	Grace System	700	210	14	0.50	1.3
	Bentonite (4lbs./1000gal.)			11	0.50	1.5
I-12	NONE			34	4.00	39
	Grace System	300	100	15	1.30	5.5
	Bentonite (2lbs./1000gal.)			11	0.40	0.3

(1) measured after 7 minutes at 97°C, followed by 24 hours at 4°C
(2) Davison technique

for wine sample I-12, a value of II = 5 to 6 NTU had been predetermined as marginal instability depending on the heat-stability test that would be used to determine it. Table 1 shows that this sample was indeed found to be marginally stable by the Vinquiry test (see Table 1, footnote #2) but was judged unstable by winery I. However, the 'Instability Index' scale is not universal since values vary with wine variety. The scale must be determined prior to a run in a manner similar to the determination of a bentonite loading requirement scale.

Future

Davison is planning a leasing agreement approach to make the system available to any size winery. This would allow wineries to lease the system (of proper size including the fining media) on a 'per-gallon fined basis'. The additional data accumulated in the spring 1986 trials have provided the company information concerning scale-up procedures for the proposed commercial-scale operations during the 1986 harvest season.

References

Bio-Rad Protein Assay, Bulletin 1069, Bio-Rad Laboratory, Richmond, CA 94804

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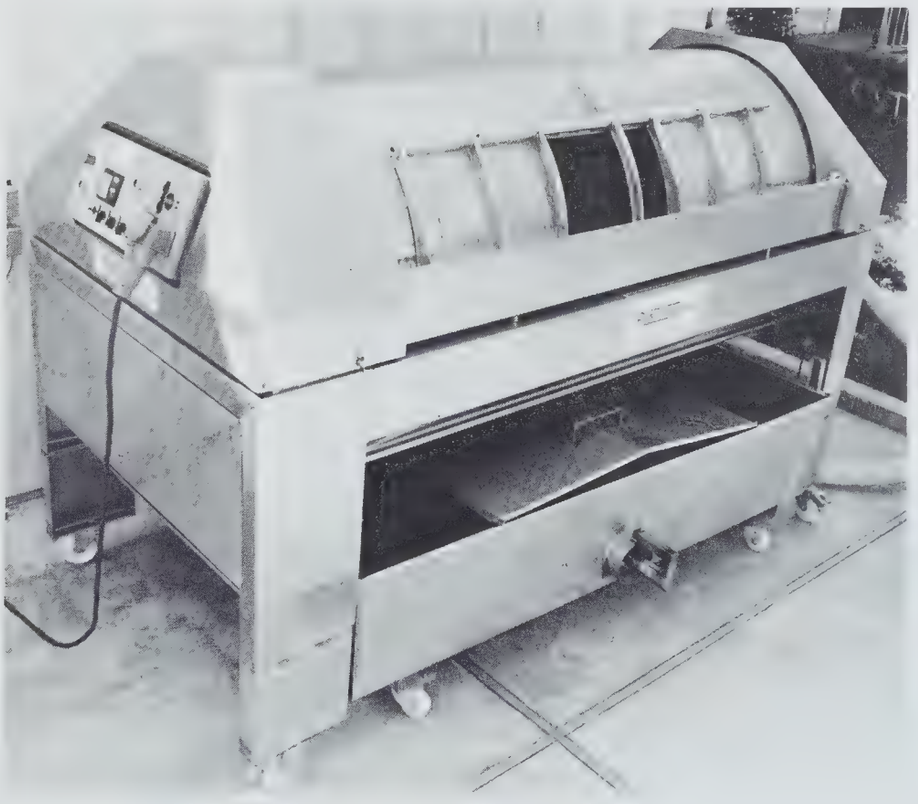

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Napa Growers Provide Grape Analysis to Wineries

Rhoda Stewart

In 1985, Napa Valley Vineyard Company set up an analysis laboratory in Rutherford, CA, to test grape samples from each of the vineyard blocks it manages for acid, sugar, and pH levels, beginning early August and continuing to harvest. The company manages almost 2,100 acres of vineyards in Napa County, and also serves as marketing agent for the grapes from these vineyards.

Results of the company's lab tests were charted and sent to its winemaking customers to use in conjunction with their own tests in determining optimum harvest date for grapes produced by vineyard blocks they buy from. The charts are also filed to become part of the company's viticultural practices data base. Bob Egelhoff, viticulturist and vineyard supervisor, is in charge of the laboratory.

Heublein started Napa Valley Vineyard Company in 1970 as a subsidiary of Vinifera Development Corporation to generate a steady supply of grapes for Heublein-owned Beaulieu Vineyards and Inglenook Winery. This was accomplished by providing vineyard management to vineyard-planting land investors in exchange for their grapes. By 1974, the company had fulfilled Heublein's needs.

Andrew Beckstoffer, an executive in charge of the management company under Heublein, purchased the company (along with other subsidiaries of Vinifera Development Corporation) and began offering vineyard management to growers. Napa Valley Vineyard Company's purpose is two-fold: to supply wineries with the best grapes proper management can produce; and to provide growers with a complete state-of-the-art management service, which includes high technology and marketing, if desired.

The lab, according to executive vice-president Roy Harris, was set up as one of the last steps towards fulfilling this double-edged purpose, and was intended to do two things: first, to bring more winery technology into the vineyard; and second, to help wineries schedule delivery dates.

Toward fulfilling the first goal, Harris believes that, although the viticulturist should not be under the sole direction of the winemaker, these two people should work closely together throughout the year, with their goal being to establish a balance between the vineyard's (and grower's) needs and the winemaker's needs.

"During the past 15 years," Harris said, "there has been a tremendous move towards bringing wineries and growers closer together. In the past, few growers had any contact with the cellaring of the wines made from their grapes, and winemakers had little influence on viticultural practices and management. But today, a close working relationship between grower and winemaker is regarded as very important." European winemakers believe that "wine is made in the vineyard"—a belief, says Harris, that this company wholeheartedly endorses.

Second, the lab was set up to show wineries that the company's interest in the vineyard does not end in August, at which time the quality of the grapes has been pretty much established. "By the end of July," Harris pointed out, "the only management option left (in good weather) is to track maturity and help pinpoint the delivery date." (In adverse weather, the options include efforts to minimize its impact.)

While scheduling delivery dates is generally the winemakers' responsibility, Napa Valley Vineyard Company feels that whatever help its lab data provides in pinpointing this date, the better it will serve both the wineries and its clients. The company's contracts with many wineries are designed with a fairly large window of acceptability for sugar levels. The highs for sugar would have to be relatively high, the lows unusually low, to incur penalties.

The lab helps the company live up to its part of these contracts. "But it does more than that," Harris emphasized. "It shows the wineries that we are as concerned with the condition of the grapes upon delivery as they are, and it is a means of making winemakers comfortable with the company's interest in wine quality. It helps us establish and maintain our reputation with them, thereby helping us better serve our clients, the growers, and ultimately the wine consumer.

"It provides another place where the viticulturist and the winemaker can interface relative to maturity and the quality of grapes," was how Harris summed up the lab's role in improving the working relationship between these two people, who, in conjunction with Mother Nature, have final responsibility for the quality of the bottled product.

Egelhoff's approach to selection of samples for analysis is thorough-going. "The accuracy of results, as an indication of the condition of the entire block," he emphasized, "is only as good as our field samples." To be sure of taking representative

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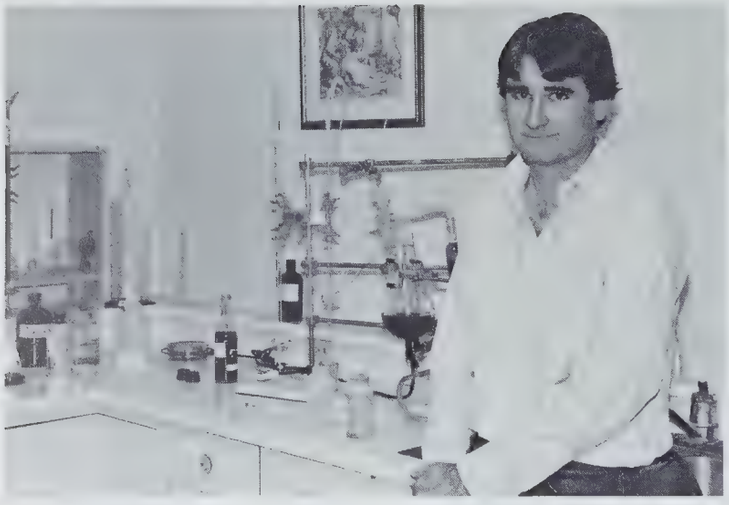

Bob Egelhoff, viticulturist, Napa Valley Vineyard Company.

field samples, Egelhoff reviews individual characteristics of each vineyard block before beginning sampling. To do this, he studies harvest histories and infra-red aerial photographs, which are taken of each vineyard annually.

Harvest histories consist of tonnage, as well as acid, sugar, and pH at picking, for previous years. From the infra-red aerial photographs, which indicate foliage density, he identifies strong and weak areas. "Representative samples are taken throughout late summer and fall," explained Egelhoff. "Nearing harvest, samples may also be taken separately from strong and weak areas, to determine the differences, if any, in the analysis criteria."

By 'representative' sample, Egelhoff means a sample at harvest that shows a low degree of deviation from the juice tank sample, which represents a thoroughly mixed product.

Egelhoff's early season samples consist of clusters to determine sugar level only. When these samples show a reading of 18° Brix for still wines and 15° for sparkling wines, which harvest at lower Brix and higher acid levels, he begins weekly sampling and charting for all three criteria of acid, sugar, and pH. Copies of these charts are sent to the winemakers.

At this point, depending on the terrain, the varietal, and preference of the winemakers, the sampling method—cluster or berry—is determined for the duration of the season. For example, all hillside samples are always berry, unless the vineyard is Zinfandel, which is always sampled by cluster because of this variety's characteristic uneven ripening within the cluster.

Egelhoff samples by the 'X-method'. For berry sampling, he applies a single X-pattern to each block. As he moves along the X-lines, he takes berries from both sides of the vine, and from the top, middle, and bottom of the cluster. He takes no berries from end vines, nor from vines near trees. Also, his samples are all taken from the vines of the predominant age of the block. For example, if most of the vines in a block are eight years old, he does not take samples from significantly younger vines.

For cluster sampling, Egelhoff breaks each block into four sub-blocks, and applies the X-pattern to each sub-block. He takes one cluster/vine, randomly choosing vines along the X-lines, but being sure to take clusters from both strong and weak vines, and to take both primary and secondary clusters. This way, he obtains four separate samples from each block.

Egelhoff reads each sample separately, then averages the results, which are charted. He does this because tests from field samples made up of clusters usually show a higher deviation from tank samples than do berry samples. By taking four samples from each block, he reduces the potential deviation.

Samples are large: 20 pounds, if cluster; or 200 berries. "Large samples, well-macerated, are necessary for an accurate pH reading, as pH is higher closer to the skin," said Egelhoff. "Even with a large sample, the pH of the tank sample is always higher than that of the field sample. (Acid and sugar readings are lower.) But with a large sample taken in accordance with each block's strong and weak areas, the sample is more likely to be representative.

As harvest nears, Egelhoff takes samples twice weekly, or even daily, depending on weather and specific requests from winemakers. Egelhoff emphasizes the importance of being consistent in coverage of the blocks: The samples must all be taken from vines along the original X-lines, and from the same parts of the clusters and vines. Data from all these samples are charted and sent immediately to the winemakers.

Analytical chemistry of the grapes as revealed by the analysis criteria is not the only basis for determining their maturity and quality, Egelhoff cautions. Physical signs presented by both vines and grapes must be considered. In the vines, some indicators of degree of maturity are brown and woody peduncles, and straw-colored or yellow stems. In the grapes, some indicators of the degree of maturity are their turgidity, taste, color, and translucency. Effects of damage caused by mildew, insects, wind, and sun must also be considered.

Charts of acid, sugar, and pH from the analysis lab are also becoming useful to viticultural management. "As we track maturity," said Harris, "we learn about physiology of the vines, and how irrigation techniques, soil condition (moisture reserves), and cropping (or overcropping) are affecting them." If the vines physiologically 'hang up' (stop the natural maturation process), the charts will show this immediately, and help the viticulturist to determine which of the above three factors is the cause.

"For example, a portion of a vineyard block seemed to hang up at 18° Brix every season. The sprinkler system of irrigation turned out to be the cause. While the irrigation practices were adequate for the vineyard in general, there was a gravel lens in this particular area that needed more frequent and/or later irrigation. This problem was solved by a valving system which permits more specific irrigation to specific areas."

The proper relationship between crop levels and the vines' ability to bring grapes to the desired maturity is also more readily determined through the data provided by the lab. Since crop level is in good part determined by pruning, this is indeed an area in which the ripening curve can assist winemakers and viticulturists in determining the best pruning approach to a vineyard block.

Egelhoff also views the lab from a broader management perspective. "We manage vineyards from Los Carneros to St. Helena," he said. "By sampling this range of vineyards throughout the summer and fall, I can see how soil and weather affect the ripening process in each microclimate."

Matching varieties to the optimum soil and climate location is a process the company is attempting to 'fine-tune'. According to Harris, those vineyards that produce grapes ranking in the top 20% of the wine quality spectrum will always be in demand. One of the company's management goals is to develop vineyards that rank in that top 20%.

Over the years, the charts of analyses will create a ripening history for each microclimate that will be invaluable both to growers and to wineries. For growers, it will assist in varietal decisions; for winemakers, it will aid in learning what to expect from grapes in each vineyard block they buy from.

Interviews with the winemakers of five of Napa Valley Vineyard Company's customers reveal satisfaction with the sampling lab service.

David Spaulding, winemaker for Stonegate Winery, Calistoga, CA, said, "We use the service because it is there. I am not going to shut my eyes to that kind of service. It's free; it's reliable; and it saves time." Stonegate Winery is at the north

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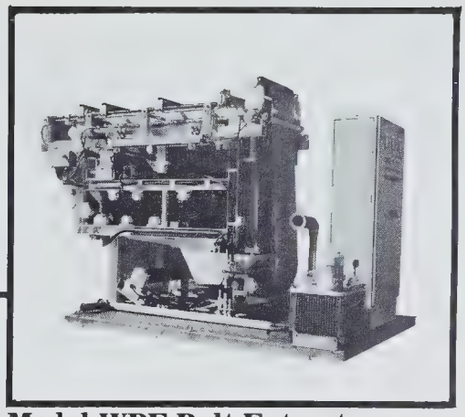
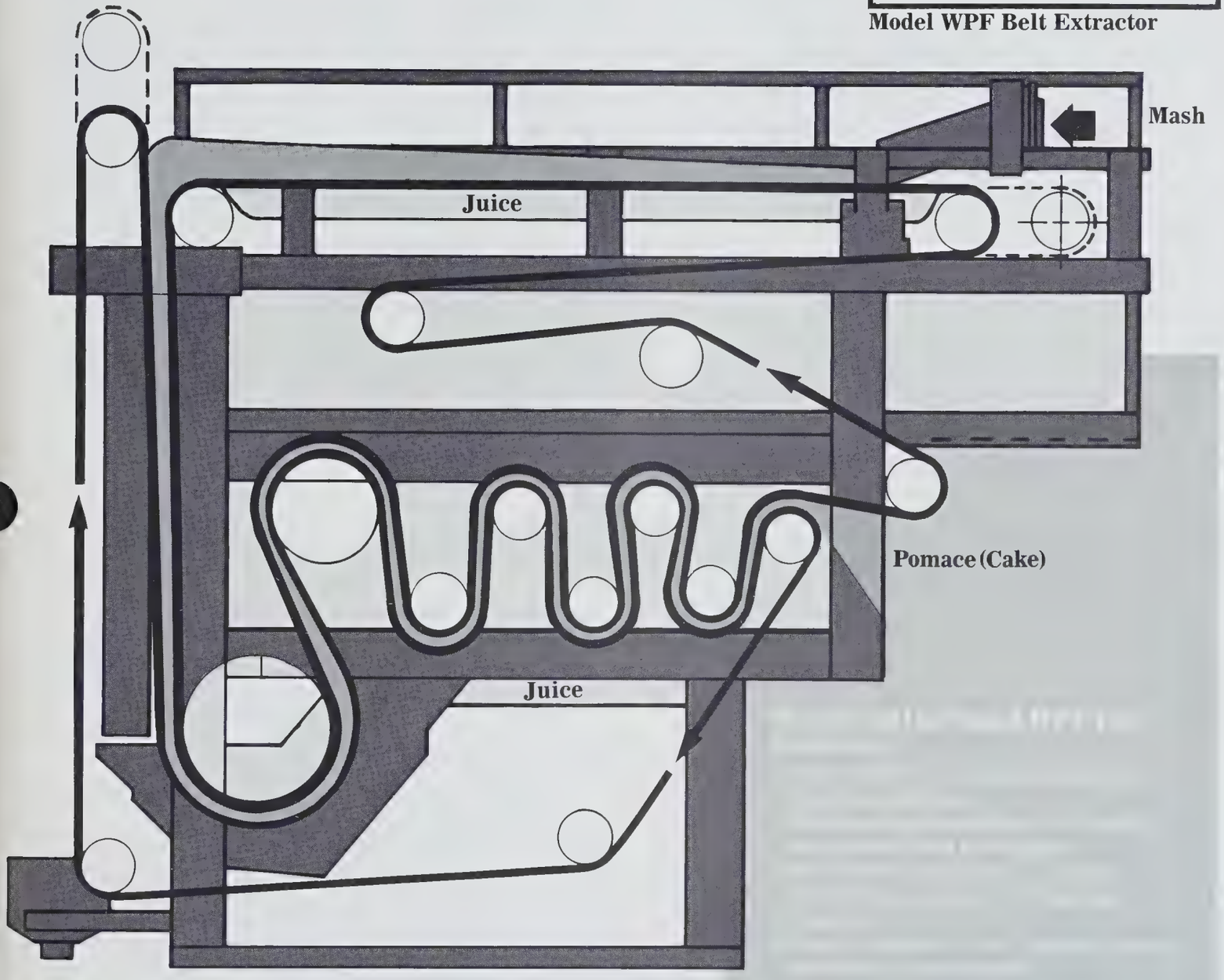


Model WPF Belt Extractor



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end of Napa Valley; some of the vineyard blocks from which Spaulding buys grapes are at the south end of the valley—15 to 20 miles away. "It's impractical for me to travel to those blocks daily. Also, some years, it is difficult to get a representative sample. With the weekly, twice-weekly, and even daily samples taken and charted by Egelhoff, these problems are overcome. The sample results are reliable and match my spot samplings. The service fits in with our needs."

Bob Travers, owner/winemaker of Mayacamas Winery, Napa, CA, described the sampling service as very helpful, and he encourages the company to continue the service. "It provides a nice cross-check by someone as close to the vineyards as Egelhoff is," said Travers. "He knows where crops are heavy or light, he knows the age of the vineyards, where to separate samples according to age of the vines, and he knows which part of a block to harvest from to satisfy tonnage requirements." Travers says he takes samples himself twice a week in hot weather near harvest time, but Egelhoff samples four times.

Although 1985 was the first harvest for which this service was offered, Travers was happy to make use of the sampling lab's results. "Napa Valley Vineyard Company is a company we've known a long time," added Travers. "It behooves them to be accurate."

Bernard Portet, owner/winemaker for Clos du Val, Napa, CA, samples all the vineyards his winery buys from twice a week beginning in August, but is happy to have other sample results to double-check with. "Any time figures don't match up," he reported, "both parties re-do the sample. And any time I miss a sample day, I know the sample is still being taken by a reliable person and lab. It's a good service and helps me do my job better."

Bruce Cakebread, winemaker for Cakebread Cellars, Rutherford, CA, approves of the service: "It's good to see the management company taking such an active and organized interest in the ripening process," he said. "Growers as well as winemakers need to see what's happening in their vineyards as grapes reach maturity. It's as valuable a service to the grower as to the winemaker."

Cakebread is pleased to see Egelhoff charting the data from his samplings. A ripening history, he feels, in conjunction with other management data, will certainly prove valuable toward improving grape quality. Cakebread, who personally samples all grapes he buys as often as the sampling lab service does, nonetheless finds Egelhoff's results valuable as a cross-check.

Walter Schug, of Schug Cellars, St. Helena, CA, especially likes the early samples supplied by Egelhoff. "Early tests give some idea of physical maturity of fruit, especially acid and pH," he said. "From these early results, you can project whether harvest will be early or late. And since you work all year to pick a perfect fruit, any service that helps you do this is valuable."

The sampling lab, Schug feels, is a service one almost expects from such a large company. Schug samples those vineyards he buys from at the end of the season when things get crucial and critical. At this point, he appreciates the lab service's results for cross-checking. "The sampling service helps immensely with scheduling," he added, "both for the company and the winemakers."

At the end of the 1985 crush, reports from the 19 wineries to whom this service was supplied indicate that while there is always a variance between field and tank samples, there were "no surprises." "The match-up," said Egelhoff, according to his best information, "for all three criteria was good."

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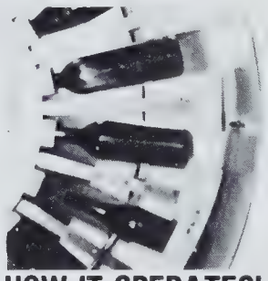

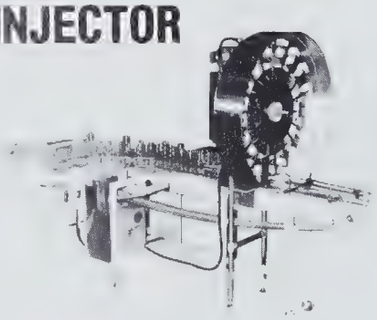

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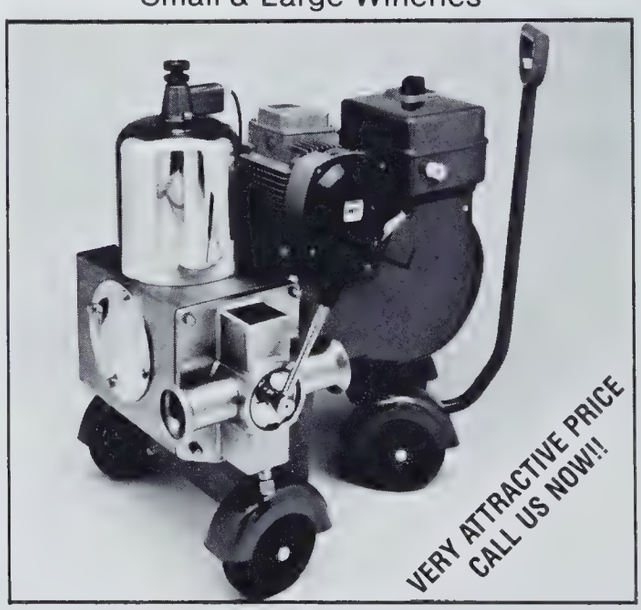

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Tank Door Buyer's Guide

Well, you've read *PW*'s May/June 1985 story on 'How to Order a Wine Tank', so you've got that decision out of the way. But have you considered what type of tank *door* would best suit your needs? Following are some considerations you'll want to keep in mind when purchasing a door to fit your new tank.

Primary among the choices you'll be called upon to make is the decision concerning shape of the door. Round, oval, and square doors are available. There are advantages to each.

Ovals, for instance, are recommended on very large tanks. They are designed to seal from the inside against the door frame, which offers a better seal, with the back pressure of the wine against the machined surface of the frame. Oval doors protrude out of the tank less than a round door, which allows more working room in confined spaces. Oval doors swing inward in case of obstructions such as ill-placed posts, and there is also less chance of bumping the handwheel with equipment, i.e. forklifts, portatanks, pumps, and presses. Some are available as combination inswing/outswing. Oval doors accommodate the shape of a person's body better than round doors and are easier to climb through.

Round doors are recommended for use in solids removal. Opening an inward-swinging oval door against two tons of pomace or two feet of lees is virtually impossible. A round door can always be opened, and a shovel or rake used to remove solids.

Square outswing doors are also recommended for solids removal. In combination with slope-to-front bottom tanks, the square door is mounted flush with the bottom front of the sloping bottom. Pomace can be removed with shovel or rake.

Manufacturers strengthen doors by using thicker materials and/or fabricating with convex or concave forms. This allows a better seal, which is especially important in very large tanks. Oval doors and round doors in comparable sizes are comparable in cost.

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A wide array of gaskets in a variety of materials is also available. Choices include rubber rim and full-face gaskets in rubber, neoprene (white or black), and Buna N. A full-face gasket, however, can cost twice as much as a rim gasket. Bolt-on type doors are available with rubber (red or white) gum and silicone (red, white and grey), viton, etc. Neoprene and silicone are slightly higher in price than the others. Some side gaskets of black rubber have been in use for 15–20 years without failure, although 5–8 years is the norm. Top-door gaskets which receive more sunlight and heat in outside installations may need replacing after a year or two, although some have lasted from 5–10 years.

Size is another important consideration. Side doors are available as follows: 18" round, 24" round, and 30" round. 16x20" inswing/outswing, 16x20" outswing, 16x22" inswing/outswing, 20x25" inswing/outswing ovals are also available. For the top, 6," 10," 18," 20," 24," and 30" round outswing/sideswing are available. (The larger ones are often twice as expensive.) Square and rectangular doors are available on top and sides by request.

Doors are generally standard in stainless steel, since a stainless door is virtually care-free. Doors can be supplied in T304 or T316 stainless steel with a choice of 2b, glass-blasted or polished finish. Mild-steel doors for non-food-grade applications can be special orders.

What do you intend to use your tank for? This, too, is an important consideration. For instance, will it be used as a red fermenter? White? Or both?

Economy is always an important consideration. The most economical doors are the 16x20" oval and 18" round, both completely of T304 stainless steel with a rubber gasket.

PW would like to thank the following tank-door manufacturers for their contributions to this story, and recommends that you contact them for further information concerning their individual product lines.

* * *

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Glycol, ammonia, freon etc. We'll give you the cold facts.

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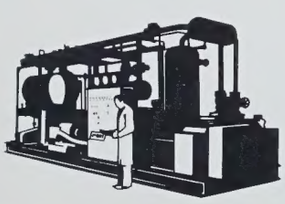

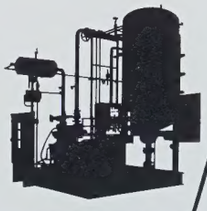

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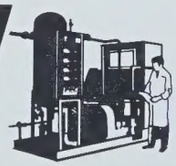

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